نقل الكهرباء
National Grid SA
إحدى شركات الشركة السعودية للكهرباء
Subsidiary of Saudi Electricity Company

FINAL

SCOPE OF WORK AND TECHNICAL SPECIFICATIONS

FOR

PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS

PTS - 24CM1046

ENGINEERING & DESIGN DIVISION-EOA

ENGINEERING & DESIGN DEPARTMENT

ENGINEERING & PROJECTS DEVELOPMENT SECTOR

ENGINEERING & ASSET MANAGEMENT BL

NATIONAL GRID SAUDI ARABIA

DESCRIPTION	NO.
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REVISIONS

DEPARTMENT
ENGINEERING & DESIGN

PREPARED BY
Project Engineers
KUMAIL N. AL-FASHKHI
DATE: 15 / 08 / 2024

APPROVED BY
Group Leader
KHALIL I. AL-HANOUN
DATE: 15 / 08 / 2024

CERTIFIED BY
E&DD-EOA DIVISION MANAGER (A)
AMEEN H. AL-HULAIMI
DATE: 15 / 08 / 2024

THIS DOCUMENT IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIALS UNTIL CERTIFIED AND DATED

DRAWING CONTROL SHEET	FINAL SOW/TS FOR PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS SAUDI ARABIA	PLANT NO.	INDEX	DOCUMENT NO.	PAGE NO.	REV.
CT-926693		NG2150	A	PTS-24CM1046	1 OF 60	01

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SOW/TS APPENDICES

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SECTION 1 INTRODUCTION

1.1 GENERAL INTRODUCTION

This Scope of Work and Technical Specifications and associated PROJECT Conceptual Drawings, which are Attachment-I to Schedule "B" of this CONTRACT, describe the specific scope of work that the MANUFACTURER is required to carry out on Lump Sum Turnkey (LSTK) basis, until the successful commissioning, completion and final acceptance of WORK, by National Grid SA (hereafter referred to as COMPANY or NG).

1.2 CONTRACT DESCRIPTION

This CONTRACT is intended to supply COMPANY with the following power transformers and reactors which will be used by SUBSTATION CONTRACTORS for construction of substations, in different areas of Kingdom of Saudi Arabia.

- 50/67 MVA, 110/13.8 kV, YNyn0+d1
- 50/67 MVA, 115/13.8 kV, Dyn1
- 50/67 MVA, 132/13.8 kV, Dyn1
- 50/67 MVA, 132/13.8 kV, YNyn0+d1
- 80/100 MVA, 132/33 kV, YNyn0+d1
- 40 MVAR, 132kV Bus Shunt Reactor

The relevant main online diagrams for typical power transformers having various parameters are shown on drawings listed in the drawing control sheet no. CT-926693.

1.3 CONTRACT SUMMARY

The MANUFACTURER shall design, engineer, manufacture, factory test, supply and supervise installation, testing & commissioning of power transformers & reactors equipment complete with all accessories along with all associated work and services in a satisfactorily manner as specified in this scope of work and technical specifications.

1.4 DEFINITION OF TERMS

Terms, abbreviations and/or expressions frequently used in this document shall have the following meaning:

TERMS/ ABBREVIATION/ EXPRESSIONS	MEANING
COMPANY	National Grid SA (Subsidiary of Saudi Electricity Company)
SEC	Saudi Electricity Company
PROJECT	Construction and/or reinforcement of substation(s) to be carried out by SUBSTATION CONTRACTOR
SUBSTATION CONTRACTOR (or CONTRACTOR)	Contractor responsible for the installation of power transformers equipment and construction of new substations in different areas of Kingdom of Saudi Arabia

MANUFACTURER	Manufacturer responsible for the execution of the WORK as described in this PTS
JOB SITE/WORK SITE	Substation SITE
ASTM	American Society for Testing and Materials
Asym.	Asymmetrical
AVC	Automatic Voltage Control
BCP	Bay Control Panel
BCU	Bay Control Unit
COMPANY REPRESENTATIVE	Personnel Authorized by COMPANY
CT	Current Transformer
CTR	Current Transformer Ratio
DCS	Drawing Control Sheet
GT	Grid Transformer
GIS	Gas Insulated Switchgear
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronics Engineers
IFC	Issued for Construction
kA	Kiloampere
kV	Kilovolt
kVA	Kilo Volt Ampere
LCC	Local Control Cabinet
LCP	Local Control Panel
LOTAM	List of Technically Acceptable Manufacturers and Manufacturer Plants
LSTK	Lump Sum Turnkey
mH	Millihenries
MVA	Mega Volt Ampere
MVar	Mega Volt Ampere Reactive
MVarh	Mega Volt Ampere Reactive Hours
MW	Megawatt
MWh	Megawatt Hours
O/H	Overhead
OLTC	On-Load Tap Changer
p.u.	Per unit
PTS	Project Technical Specifications
QA/QC	Quality Assurance/Quality Control
RTCC	Remote Tap Changer Control
S/S or SS	Substation
SA	Surge Arrestor
SASO	Saudi Arabian Standards Organization
SCADA	Supervisory Control and Data Acquisition
SEEDS	SEC Engineering Drawings Standard

SOW/TS	Scope of WORK and Technical Specifications
sq.mm	Square millimeters or Square mm or mm2
SGT	Super Grid Transformer
TCS	COMPANY Transmission Construction Standard
TES	COMPANY Transmission Engineering Standard
TFR or DFR	Transient Fault Recorder or Digital Fault Recorder
TMSS	COMPANY Transmission Materials Standard Specification
TSD	COMPANY Transmission Standard Drawings
T/L, T/Line	Transmission Line
U/G or UG	Underground
WP	Work Package
X/R	The ratio of reactance to resistance
XFMR	Transformer

END OF SECTION 1

SECTION 2 INTERFACE REQUIREMENTS

A. GENERAL

This section describes the scope of general interface of the POWER TRANSFORMERS/REACTORS MANUFACTURER /CONTRACTOR /COMPANY involved in this CONTRACT.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
1.	Drawing Numbers	The MANUFACTURER'S drawings shall be assigned with drawing numbers and indexed as per COMPANY requirements (SEED-II). Each design package shall have dedicated drawing numbers.	The CONTRACTOR'S drawings shall be assigned with drawing numbers and indexed as per COMPANY requirements (SEED-II). The CONTRACTOR shall reflect the related MANUFACTURER drawings in the required related substation drawings.	A block of drawing numbers to be provided by the COMPANY for all new drawings/documents at various stages of EQUIPMENT design.
2.	EQUIPMENT Preliminary Design Package(s)	MANUFACTURER shall submit complete set(s) of EQUIPMENT preliminary design package(s) (Hard and soft copy) after the PURCHASE CONTRACT kick-off meeting. MANUFACTURER to arrange the EQUIPMENT preliminary design review meeting.		COMPANY to review the EQUIPMENT preliminary design package(s). COMPANY representatives to attend preliminary design review meeting. COMPANY to concur on the minutes of the meeting.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		MANUFACTURER'S representative(s) in each field of specification to attend the presentation meeting to finalize the EQUIPMENT preliminary design package(s). MANUFACTURER to prepare minutes of the meeting.		
3.	EQUIPMENT Final Detail Design Package(s)	MANUFACTURER shall submit complete set(s) of EQUIPMENT final detail design package(s) (Hard and soft copy) after finalizing the preliminary design. MANUFACTURER to arrange the EQUIPMENT final design review meeting. MANUFACTURER'S representative(s) in each field of specification to attend the presentation meeting to finalize the EQUIPMENT detail design package(s). MANUFACTURER to prepare minutes of the meeting.		COMPANY to review the EQUIPMENT final detail design package(s). COMPANY representatives to attend final detail design review meeting. COMPANY to concur on the minutes of the meeting.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
4.	PROJECT(S) Base Design Package(s)	MANUFACTURER'S representative(s) in each field of specification to attend the presentation meeting to finalize EQUIPMENT design of related PROJECT(S). MANUFACTURER to concur on the minutes of the meeting on points related to purchase contract equipment.	SUBSTATION CONTRACTOR shall submit the PROJECT(S) base design packages(s) (Hard and soft copy) after the PROJECT(S) kick-off meeting. SUBSTATION CONTRACTOR'S representative(s) in each field of specification to attend the presentation meeting to finalize PROJECT(S) base design. SUBSTATION CONTRACTOR to prepare minutes of the meeting.	COMPANY to review the PROJECT(S) base design package(s). COMPANY to arrange the PROJECT(S) review meeting. COMPANY to concur on the minutes of the meeting.
5.	EQUIPMENT "As-Manufactured" Package(s)	MANUFACTURER shall submit complete set(s) of all drawings and documents (Hard and soft copy) stamped as "As-Manufactured" before EQUIPMENT factory inspection & testing (FAT).		COMPANY to review the EQUIPMENT "As-Manufactured" package(s).
6.	Quality control/Quality assurance Factory inspection and testing (FAT)	The MANUFACTURER shall submit to COMPANY quality control, inspection and testing plan of EQUIPMENT for COMPANY review.		COMPANY to review and approve the quality control, inspection and testing plan. COMPANY to review and approve schedule for factory

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		MANUFACTURER shall submit factory inspection schedule of EQUIPMENT, after receiving the related “Purchase Order” for COMPANY review. MANUFACTURER shall arrange traveling requirements of COMPANY personnel for witnessing factory inspection & testing of EQUIPMENT. MANUFACTURER shall contract with COMPANY approved quality assurance and quality control services CONTRACTOR(S) to provide quality control/quality assurance monitoring of all quality activities related to manufacturing of EQUIPMENT. MANUFACTURER shall incorporate all the comments raised during FAT in the factory before delivery, as applicable. MANUFACTURER shall control the interface and		inspection of EQUIPMENT. COMPANY shall provide SUBSTATION CONTRACTOR a copy of EQUIPMENT technical data manual.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		interaction between the COMPANY and QA/QC services CONTRACTOR(S) [Independent Inspection Agency(ies)]. MANUFACTURER shall hand over to COMPANY copy(ies) of EQUIPMENT test record book and copy(ies) of technical data manual.		
7.	EQUIPMENT "Final As-Manufactured" Package(s)	MANUFACTURER shall submit complete set(s) of all drawings and documents (Hard and soft copy) stamped as "Final As-Manufactured" after incorporating all the comments raised in "As-Manufactured" packages(s) and during FAT.		COMPANY to review EQUIPMENT "Final As-Manufactured" package(s).
8.	EQUIPMENT "As-Built" Drawings	MANUFACTURER shall coordinate with the COMPANY for drawings marked with SITE changes. MANUFACTURER shall incorporate all the SITE changes, marked in "Noted By" drawings, in sufficient details to present an accurate record for the COMPANY and submit "As-Built"	SUBSTATION CONTRACTOR shall mark all the SITE changes in "Issued for Construction" drawings and shall handover them to COMPANY.	COMPANY to handover the SITE marked drawings to MANUFACTURER in order to prepare "As-Built" drawings in sufficient details to present an accurate record for COMPANY. COMPANY to review and approve "As-Built" drawings.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		drawings to the COMPANY.		
9.	EQUIPMENT Design Package(s) Documents Format	MANUFACTURER shall provide all the equipment and interface drawings to COMPANY at every stage in Microstation and PDF formats, as applicable.	SUBSTATION CONTRACTOR shall coordinate with the COMPANY for the necessary drawings to be incorporated in CONTRACTOR's design drawings at every stage, as applicable.	COMPANY to receive the drawings from MANUFACTURER at every stage in Microstation and PDF formats, as applicable.
10.	Power Transformer/Reactor Notification & Purchase Orders	MANUFACTURER to acknowledge the receiving of "Power Transformer/Reactor Notification" & "Purchase Order". MANUFACTURER shall not commence manufacturing activities of the ordered EQUIPMENT until the related Purchase Order is issued by the COMPANY.		COMPANY to issue "Power Transformer/Reactor Notification" of EQUIPMENT for specified PROJECT(S). COMPANY to issue related Purchase Order.
11.	EQUIPMENT Progress Report	MANUFACTURER to submit monthly progress reports in COMPANY approved formats (Hard and soft copy) to the responsible COMPANY representative. MANUFACTURER to attend coordination meeting(s) for EQUIPMENT progress during the	SUBSTATION CONTRACTOR to coordinate and follow up with COMPANY for EQUIPMENT progress. SUBSTATION CONTRACTOR to attend coordination meeting(s) for EQUIPMENT progress during	COMPANY to coordinate and follow up with MANUFACTURER for EQUIPMENT progress and coordinate with SUBSTATION CONTRACTOR accordingly. COMPANY to arrange coordination meeting(s) for

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		period of the PROJECT(S) as found necessary by COMPANY.	period of the PROJECT(S). The SUBSTATION CONTRACTOR to prepare the minutes of all meetings for EQUIPMENT progress.	EQUIPMENT progress during the period of the PROJECT(S).
12.	Release for Shipment, Delivery & Handover	MANUFACTURER is responsible to arrange insurance, ship and deliver EQUIPMENT and unload the EQUIPMENT on foundation at SUBSTATION SITE in Saudi Arabia. ALL cost of custom clearance of EQUIPMENT and custom duties and fee to be borne by MANUFACTURER. MANUFACTURER shall not ship the EQUIPMENT until receiving a release for shipment certificate issued by COMPANY. MANUFACTURER shall coordinate with COMPANY for the delivery schedule. MANUFACTURER shall submit to COMPANY a document of EQUIPMENT	SUBSTATION CONTRACTOR is responsible for construction of EQUIPMENT foundation at SUBSTATION SITE. SUBSTATION CONTRACTOR is responsible to develop a safe yard/place where loose materials/panels/relays etc. shall be placed.	COMPANY to issue "Release for Shipment" certificate.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		handover to SUBSTATION CONTRACTOR. This document shall indicate PROJECT(S) information, purchase order reference, shipment certificate, time and date of handover and the status of EQUIPMENT packing with acknowledgement of SUBSTATION CONTRACTOR.		
13.	Receipt Inspection	MANUFACTURER shall conduct receipt inspection of EQUIPMENT after delivery at PROJECT(S) SITE and during opening of EQUIPMENT packing. MANUFACTURER shall submit a receipt inspection report with SUBSTATION CONTRACTOR concurrence to the COMPANY. MANUFACTURER to receive the record of the impact recorder from the SUBSTATION CONTRACTOR, analyze the same and inform the COMPANY of his evaluation and findings.	SUBSTATION CONTRACTOR shall conduct receipt inspection of EQUIPMENT after delivery at PROJECT(S) SITE and during opening of EQUIPMENT packing. SUBSTATION CONTRACTOR shall remove/dismantle the impact recorder in the presence of the COMPANY representative and forward the records to the MANUFACTURER for further analysis. SUBSTATION CONTRACTOR shall repack the EQUIPMENT under MANUFACTURER	COMPANY to conduct receipt inspection of EQUIPMENT after delivery at PROJECT(S) SITE. COMPANY to witness removal/dismantling of the impact recorder and acknowledge receiving MANUFACTURER's evaluation for impact records.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
			supervision, in case the foundation is not ready as per the committed schedule. SUBSTATION CONTRACTOR shall promptly report to the COMPANY any shipment and transportation damage.	
14.	EQUIPMENT Replenish / Replacement	See Section 3.19	See Section 3.19	See Section 3.19
15.	Installation, Testing and Commissioning	MANUFACTURER shall provide complete SITE installation, testing and commissioning procedures of the EQUIPMENT supplied to SUBSTATION CONTRACTOR before shipment. MANUFACTURER shall conduct inspection and supervision of testing activities of EQUIPMENT at all phases and quality audit at appropriate stages of the PROJECT(S) construction/installat ion. Cost of MANUFACTURER supervisor(s) including air ticket to PROJECT SITE(S)	Installation, testing and commissioning work of EQUIPMENT shall be borne by SUBSTATION CONTRACTOR under direct MANUFACTURER supervision. SUBSTATION CONTRACTOR shall intimate and notify MANUFACTURER in advance the supervision plan and the required date of supervisor availability at PROJECT(S) SITE.	All SITE testing and commissioning shall be done under COMPANY witness.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		and back, VISA, insurance, food, accommodation, local transportation requirements from hotel to job site and back shall be arranged and borne by MANUFACTURER. MANUFACTURER shall obligate to SUBSTATION CONTRACTOR plan for supervision. The supervision duration of installation, testing and commissioning as per COMPANY specifications and requirements is: - 25 working man-days for one (1) transformer/Reactor EQUIPMENT.		
16.	Operational Spare Parts	MANUFACTURER shall provide and deliver operational spare parts to designated COMPANY warehouse(s) in Saudi Arabia.		COMPANY to issue an order(s) for operational spare parts during PURCHASE CONTRACT.
17.	Special Tools/Test Equipment	MANUFACTURER shall provide and deliver special tools/test equipment to COMPANY designated warehouse(s), as required by COMPANY.		COMPANY to issue an order(s) for any special tools/test equipment during PURCHASE CONTRACT.

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		In case, the MANUFACTURER requires to perform any special test/check, MANUFACTURER shall provide/use his own tools/test equipment. MANUFACTURER shall be responsible for the insurance of the new special tools/test equipment(s) ordered by COMPANY up to final destination.		
18.	Training	MANUFACTURER shall submit factory training program for COMPANY review and approval. MANUFACTURER shall arrange factory training complete with all required instructional materials and travelling requirements. SITE demonstration during installation and testing shall be conducted by MANUFACTURER supervisor(s).		COMPANY to issue an order(s) for factory training requirements during PURCHASE CONTRACT.
19.	Warranty Certificate	MANUFACTURER shall provide COMPANY, a		If COMPANY found the EQUIPMENT to be defective within

#	Work	MANUFACTURER	SUBSTATION CONTRACTOR	COMPANY
		warranty certificate for the EQUIPMENT.		the warranty period, COMPANY to arrange for warranty claim.

B. TRANSFORMER EQUIPMENT/WORK INTERFACE

This section describes interface jobs/activities between the EQUIPMENT MANUFACTURER and SUBSTATION CONTRACTOR. These jobs/activities shall be coordinated through the COMPANY REPRESENTATIVE.

#	Work / Equipment / Item	TRANSFORMER MANUFACTURER	SUBSTATION CONTRACTOR
1.	Power Transformers	Design, engineer, manufacture, factory test, supply of power transformers with all appurtenances and accessories. Provide supervision of the installation, testing and commissioning of the power transformers with all associated works and services until the successful commissioning and final acceptance of the work by the COMPANY.	Installation, testing and commissioning of power transformers with all appurtenances and accessories and all associated work and services until the successful commissioning and final acceptance of the work by the COMPANY.
2.	132/115/110kV and 13.8/33kV cables (as applicable)	Provide suitable metallic cable glands with shrouds for sealing all cable entries at the enclosures. Provide flexible links between cables and bushings in LV cable box.	Provide, install, splice, terminate, test and commission 132/115/110kV and 13.8/33kV cables in power transformers HV bushings/cable boxes (as applicable) and LV cable boxes including cable support structures and required grounding materials.
3.	Outdoor bushing connectors	Provide terminal hard wares and accessories suitable for 1 x 795 kcmil ACSR overhead conductors per phase on 132/115/110kV bushing of power transformers (Air).	Provide, install, terminate, test and commission 1 x 795 kcmil ACSR overhead conductor per phase, with termination hard wares and accessories (for 132/115/110kV bushing (SF6/Cable/Air)) for connection

#	Work / Equipment / Item	TRANSFORMER MANUFACTURER	SUBSTATION CONTRACTOR
			between 132/115/110kV bushing (SF6/Cable/Air) and HV bushing of power transformers (Air).
4.	LV Auxiliary power and control cables (External to the power transformers and their local control cabinet)	Provide all LV Auxiliary power and control cables to be installed between Power Transformer accessories and local control cabinet/OLTC MDU.	Provide, install, splice, terminate, test and commission all LV Auxiliary power and control cables to be installed between Power Transformer local control cabinet and substation control room including all required materials.
5.	Surge Arresters	Provide (96, 108 or 120 kV; as applicable) outdoor, station class, metal-oxide Surge Arresters. Provide mounting brackets of the surge arresters adjacent to the HV outdoor air bushings.	Install onto brackets of power transformers, terminate, test and commission surge arresters.
6.	Transformer HV & LV Neutral Grounding	Provide HV & LV neutral grounding bars/leads for transformer ground connections, as applicable. Provide the HV & LV neutral bushings, support insulators and suitable brackets on transformer tank for grounding wires insulation from transformer tank as per clause 12.1 of TES-P-119.10.	Provide, install, splice, terminate, test and commission all grounding connections of power transformers to the substation grounding grid/NGR; (as applicable) including all required materials.
7.	Transformer Tank Grounding	Provide the provision for power transformer tank grounding as per clause 4.19 of 53-TMSS-01.	Provide, terminate, test and commission grounding cables at two point of the power transformer tank as per clause 12.1 of TES-P-119.10.
8.	Neutral Grounding Resistors (NGR) (if applicable)	Cable Tray/Support on the Power Transformer shall be provided for the cable connecting the NGR with LVN Bushing.	Provide, install, test, commission and terminate the neutral grounding resistors (NGRs) to the power transformers LVN Bushing. The

#	Work / Equipment / Item	TRANSFORMER MANUFACTURER	SUBSTATION CONTRACTOR
			connecting cable shall be 1C x 630 mm2.
9.	Grounding Transformer (if applicable)	Provide the provision for grounding transformer in the LV Cable Box.	Provide, install, terminate, test and commission three phase interconnected star (zigzag) type (ZN) grounding transformer.
10.	Online Gas Analyzer	Online Gas Analyzer is not required under this Contract. However, Power Transformers shall be design to have the required provision to the same for future use.	
11.	Work Coordination	Coordinate all WORK and construction interface activities with all other CONTRACTORS/Agencies and COMPANY as necessary for successful completion of all interface activities by others.	Coordinate all WORK and construction interface activities with all other MANUFACTURERS, CONTRACTORS/Agencies and COMPANY as necessary for successful completion of all interface activities by others.

C. SHUNT REACTOR EQUIPMENT/WORK INTERFACE

This section describes interface jobs/activities between the EQUIPMENT MANUFACTURER and SUBSTATION CONTRACTOR. These jobs/activities shall be coordinated through the COMPANY REPRESENTATIVE.

#	Work / Equipment / Item	TRANSFORMER MANUFACTURER	SUBSTATION CONTRACTOR
1.	SHUNT REACTOR	Design, engineer, manufacture, factory test, supply of shunt reactor with all appurtenances and accessories. Provide supervision of the installation, testing and commissioning of the shunt reactor with all associated works and services until the successful commissioning and final	Installation, testing and commissioning of shunt reactors with all appurtenances and accessories and all associated work and services until the successful commissioning and final acceptance of the work by the COMPANY.

#	Work / Equipment / Item	TRANSFORMER MANUFACTURER	SUBSTATION CONTRACTOR
		acceptance of the work by the COMPANY.	
2.	132/115/110kV cables (as applicable)	Provide suitable metallic cable glands with shrouds for sealing all cable entries at the enclosures.	Provide, install, splice, terminate, test and commission 132/115/110kV cables in shunt reactors bushings/cable boxes (as applicable) including cable support structures and required grounding materials.
3.	Outdoor bushing connectors	Provide terminal hard wares and accessories suitable for 1 x 795 kcmil ACSR overhead conductors per phase on 132/115/110kV bushing of shunt reactors (Air).	Provide, install, terminate, test and commission 1 x 795 kcmil ACSR overhead conductor per phase, with termination hard wares and accessories (for 132/115/110kV bushing (SF6/Cable/Air)) for connection between 132/115/110kV bushing (SF6/Cable/Air) and bushing of shunt reactors (Air).
4.	LV Auxiliary power and control cables (External to the shunt reactors and their local control cabinet)	Provide all LV Auxiliary power and control cables to be installed between Shunt reactor accessories and local control cabinet/OLTC MDU.	Provide, install, splice, terminate, test and commission all LV Auxiliary power and control cables to be installed between Shunt reactor local control cabinet and substation control room including all required materials.
5.	Surge Arresters	Provide (96, 108 or 120 kV; as applicable) outdoor, station class, metal-oxide Surge Arresters. Provide mounting brackets of the surge arresters adjacent to the outdoor air bushings.	Install onto brackets of shunt reactors, terminate, test and commission surge arresters.
6.	Shunt Reactor Tank Grounding	Provide the provision for shunt reactor tank grounding.	Provide, terminate, test and commission grounding cables at two point of the shunt reactor tank as per clause 12.1 of TES-P-119.10.

#	Work / Equipment / Item	TRANSFORMER MANUFACTURER	SUBSTATION CONTRACTOR
7.	Online Gas Analyzer	Online Gas Analyzer is not required under this Contract. However, Shunt reactors shall be design to have the required provision to the same for future use.	
8.	Work Coordination	Coordinate all WORK and construction interface activities with all other CONTRACTORS/Agencies and COMPANY as necessary for successful completion of all interface activities by others.	Coordinate all WORK and construction interface activities with all other MANUFACTURERS, CONTRACTORS/Agencies and COMPANY as necessary for successful completion of all interface activities by others.

END OF SECTION 2

SECTION 3 BASIC REQUIREMENTS AND GUIDELINES

3.1 GENERAL CONDITIONS

A. All components and accessories required for the completion and successful operation of the WORK covered under the scope of this PURCHASE CONTRACT, either specified in detail or not, shall be supplied by the MANUFACTURER as necessary.

B. The engineering design and specification of equipment/materials supplied under this PURCHASE CONTRACT shall be in accordance with this scope of work, technical specifications and COMPANY standards.

C. The drawings enclosed with this scope of work and technical specifications are conceptual and for the information of MANUFACTURER only. The MANUFACTURER should read these drawings in conjunction with this scope of work and technical specifications. The successful MANUFACTURER shall develop detailed design drawings for construction purposes.

D. The specifications of EQUIPMENT specified herein are to be considered as the minimum requirements, and the MANUFACTURER shall carry out his own EQUIPMENT basic and detailed design necessary for his proposed specifications.

E. All documents, drawings, data and instruction books to be submitted by the MANUFACTURER shall be written in English language and Metric unit system.

F. COMPANY'S acceptance of the MANUFACTURER'S design does not relieve him of any part of his obligations to meet all the requirements of this PURCHASE CONTRACT nor the responsibility for the correctness of the design drawings of EQUIPMENT to the related PROJECT(S).

G. MANUFACTURER shall have a local office in Saudi Arabia as full authorized representative for managing, coordinating activities, close communication, handling and supervising this PURCHASE CONTRACT.

H. MANUFACTURER shall provide complete address of his office in Saudi Arabia and full contact information. All correspondence and notices will be made at the provided MANUFACTURER office address in Saudi Arabia. Any change in address or key personnel, COMPANY shall be notified promptly.

I. MANUFACTURER shall provide full details for his Saudi Bank Account in order to facilitate payments for the purchase orders.

3.2 PURCHASE CONTRACT KICK-OFF MEETING

A Kick-Off meeting will be held in COMPANY Headquarters shortly after the award of this PURCHASE CONTRACT. This meeting will cover EQUIPMENT design stage, scope

of work, schedule and will give MANUFACTURER an opportunity to discuss all matters related to carrying out his responsibilities and interface points.

3.3 EQUIPMENT DESIGN PHASE

A. GENERAL

The EQUIPMENT design stage for this PURCHASE CONTRACT is an 8-10 week period from the kick-off meeting. The purpose of the EQUIPMENT design stage is to completely define the EQUIPMENT in enough details to ensure the COMPANY that all requirements are being met. Information developed during the EQUIPMENT design shall be used as a guide throughout the PROJECT(S) and shall be considered binding on both parties, unless operational difficulties or design flaws observed during detailed design review are noted and mandate change. MANUFACTURER is responsible to provide any design/data required in the scope of work and technical specifications of PROJECT(S).

B. PRELIMINARY DESIGN PACKAGE(S)

The MANUFACTURER shall submit, for each EQUIPMENT type, two (2) sets of EQUIPMENT preliminary design documents (Hard and soft copy) within four (4) week period after the PURCHASE CONTRACT kick-off meeting.

The EQUIPMENT design submittal shall be submitted fully complete. Partial submittals of package(s) are unacceptable and will be rejected. Additional drawings, if provided, will not be reviewed during the EQUIPMENT preliminary design stage.

C. FINAL DETAIL DESIGN PACKAGE(S)

The MANUFACTURER shall submit, for each EQUIPMENT type, two (2) sets of EQUIPMENT detail design documents (Hard and soft copy) within four (4) week period after finalizing the EQUIPMENT preliminary design.

The EQUIPMENT detail design package(s) shall be submitted fully complete. Partial submittals of package(s) are unacceptable and will be rejected.

D. MANUFACTURER DRAWINGS

1. All MANUFACTURER drawings shall be subject to review and approval by the COMPANY at various stages (Bid/EQUIPMENT preliminary design/EQUIPMENT final detail design/PROJECT(S) base design/PROJECT(S) final detail design/As-Manufactured/Final As-Manufactured/As-Built).

2. The MANUFACTURER shall submit typical samples for drawings in Flash Memory/internet cloud link along with EQUIPMENT design package(s) for COMPANY review and check of drawings' conformance to the requirements of the COMPANY engineering drawing preparation standards (SEEDS-II).

3. The drawings shall be assigned with drawing numbers and indexed as per COMPANY requirements. A block of drawing numbers shall be provided by the COMPANY for all new drawings/documents at various stages (Bid/EQUIPMENT preliminary design/EQUIPMENT final detail design/PROJECT(S) preliminary design/PROJECT(S) final detail design/As-Manufactured/Final As-Manufactured/As-Built).

4. MANUFACTURER drawings are design drawings, data schedules, specification sheets, installation, operating instructions and any other data required for EQUIPMENT installation. Such information is an integral part of the purchase order and shall be specified by the MANUFACTURER.

   Note: All MANUFACTURER drawings shall be consistent with main drawings in all respects and the MANUFACTURER drawings shall clearly indicate all inter references with main drawings and all other MANUFACTURER drawings, as applicable.

3.4 EQUIPMENT PRELIMINARY REVIEW

MANUFACTURER shall present the EQUIPMENT preliminary design package(s) for technical review along with the drawing control sheet. MANUFACTURER'S representative(s) in each field of specification shall attend the presentation meeting. During this meeting, the COMPANY'S comments on the EQUIPMENT design package(s) will be reviewed and discussed in detail to finalize the EQUIPMENT design.

Minutes of the meeting shall be prepared by the MANUFACTURER and concurred by the COMPANY representative(s).

3.5 EQUIPMENT FINAL DETAIL DESIGN REVIEW

MANUFACTURER shall present the EQUIPMENT final design package(s) for technical review along with the drawing control sheet. MANUFACTURER'S representative(s) in each field of specification shall attend the presentation meeting. During this meeting, the COMPANY'S comments on the EQUIPMENT final design package(s) will be reviewed and discussed in detail to finalize the EQUIPMENT detail design.

Minutes of the meeting shall be prepared by the MANUFACTURER and concurred by the COMPANY representative(s).

3.6 EQUIPMENT FINAL DETAIL DESIGN CERTIFICATION

MANUFACTURER shall submit point wise compliance statement to COMPANY'S comments and obtain approval for all final detail design package(s) after incorporating COMPANY comments.

3.7 PROJECT(S) BASE DESIGN PHASE

The MANUFACTURER shall submit three (3) sets of the PROJECT(S) base design documents (Hard and soft copy) within four (4) weeks period after the PROJECT(S) kick-off meeting.

3.8 PROJECT(S) BASE DESIGN REVIEW

MANUFACTURER'S representative(s) in each field of specification shall attend the presentation meeting. During this meeting, the COMPANY'S comments on the base design package(s) will be reviewed and discussed in detail to finalize the base design for the PROJECT(S) and EQUIPMENT design of related PROJECT(S).

Minutes of the meeting will be prepared by the SUBSTATION CONTRACTOR and concurred by COMPANY and MANUFACTURER representative(s).

3.9 AS-MANUFACTURED DRAWINGS

MANUFACTURER shall furnish two (2) complete set of all drawings (Hard and soft copy) to COMPANY stamped as "As-Manufactured", two (2) weeks before EQUIPMENT factory acceptance test. Drawings shall have the P.O. number and Power Transformer ID (as per clause 4.02) on each sheet for the designated projects.

3.10 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

A. Quality Management

MANUFACTURER shall implement an effective quality management which addresses all direct and indirect activities related to this PURCHASE CONTRACT to ensure that all contractual conditions are met. Quality planning, quality control, quality assurance and quality improvement shall be part of MANUFACTURER's quality management. To effectively manage the EQUIPMENT quality, MANUFACTURER shall develop a clearly defined EQUIPMENT Quality Plan/Quality Program. The EQUIPMENT Quality Plan/Quality Program shall be implemented through all stages during manufacturing process starting from procurement, reception of raw material, manufacturing/fabrication and until EQUIPMENT delivery. In addition, MANUFACTURER is also required to develop and implement quality control/Inspection and testing plan for EQUIPMENT as per Section 3.10.C.

B. EQUIPMENT Quality Plan/Quality Program

1. The EQUIPMENT Quality Plan/Quality Program shall set out the specific quality procedures and practices, resources, and all activities (in sequence) relevant to this PURCHASE CONTRACT. The EQUIPMENT Quality Plan/Quality Program shall

address QA/QC activities during design, procurement, manufacturing/fabrication, storage, delivery, installation, testing and commissioning of all items of WORK and EQUIPMENT.

2. The EQUIPMENT Quality Plan/Quality Program shall be submitted to the COMPANY as part of the EQUIPMENT design package for review and approval.

3. The EQUIPMENT Quality Plan/Quality Program shall clearly define and address the following:

a. Procurement Control

MANUFACTURER's QA/QC engineers shall review all products and services prior to procurement to ensure conformance to specified requirements. Procurement control shall include source evaluation and selection, source inspection and evaluation of objective evidence of quality furnished by the MANUFACTURER against the EQUIPMENT specification.

b. Quality Audit

MANUFACTURER shall conduct its own internal quality surveillance at appropriate stages (e.g. design, procurement, storage, installation and commissioning stage) of the EQUIPMENT to determine compliance to and the effectiveness of the EQUIPMENT Quality Plan/Quality Program. Each element of the EQUIPMENT Quality Plan/Quality Program shall be assessed at least three (3) times during PURCHASE CONTRACT. The schedule and frequency should be adjusted if one or more of the following conditions exist:

i. Result of previous surveillance indicates a need to perform them more frequently.

ii. Significant changes are made in the EQUIPMENT Quality Plan/Quality Program.

iii. Safety, performance or reliability of an item is questionable due to non-conformance.

iv. Verification of corrective action implementation.

Personnel conducting the quality surveillance shall be independent of those having direct responsibility for the specific activities or areas being evaluated or assessed.

c. Non-Conformance Control

MANUFACTURER shall ensure that items and services which do not conform to specified requirement are controlled in accordance with documented procedures to prevent unintended use. MANUFACTURER shall identify, document, segregate, evaluate and dispose non-conforming items and services after proper notification of concerned personnel within the MANUFACTURER'S organization.

MANUFACTURER'S QA/QC engineer/inspector shall re-inspect repaired and reworked non-conforming items. MANUFACTURER shall not use any repaired item or product unless approved by the COMPANY.

Under this clause, the following definitions apply:

i. Repair - Action taken on a non-conforming product so that it will fulfill the intended usage requirements although it may not conform to the original specified requirements (ISO 9000:2015).

ii. Rework - Action taken on a non-conforming product so that it will fulfill the specified requirement (ISO 9000:2015).

MANUFACTURER'S QA/QC engineers/inspectors shall have the freedom to issue NCRs, verify implementation of corrective actions and prevent use of non-conforming items until the deficiency has been satisfactorily resolved.

d. <u>Corrective Action</u>

MANUFACTURER shall develop, document and implement a system for determining the root cause of non-conformities and identifying the required corrective actions. New procedures or changes to existing procedures resulting from identification of the root cause and potential root cause of non-conformances shall be documented and implemented. Follow-up action shall be taken to verify effective implementation of corrective action.

e. <u>Quality Records</u>

MANUFACTURER shall develop and maintain a system for preparation, maintenance, protection and preservation of quality records. Documents such as inspection reports, field inspection checklist, factory test reports, laboratory test reports, witnessed test reports, inspection logbooks, equipment calibration records/certificates, drawings and specifications, approved submittals and non-conformance reports are part of these records.

f. <u>Control of Inspection, Measuring and Testing Equipment</u>

All measuring and testing equipment and devices which can affect the quality of construction shall be controlled and maintained. MANUFACTURER shall develop and implement a documented calibration control program indicating equipment calibration schedule and identifying those who are responsible for control of the EQUIPMENT. MANUFACTURER shall ensure that only properly identified and calibrated measuring and testing equipment are used. Equipment calibration certificates shall be presented to the COMPANY representative(s), prior to commencement of related jobs.

g. Document Control

MANUFACTURER shall develop and maintain a documented control program for the review, approval, revision and distribution of documents for the activities affecting quality. Responsible personnel for revision, issuance and approval of documents shall be identified. Control shall ensure that all pertinent and current issues of appropriate documents are available at locations where they are essential and obsolete or superseded documents are promptly removed. MANUFACTURER shall list all the documents that have to be controlled and shall include EQUIPMENT Quality Plan/Quality Program, quality control plan/inspection and test plan, drawings, calculations, correspondence, inspection and test reports, field inspection checklist, etc.

h. Material/Equipment Handling, Storage, Identification and Control

MANUFACTURER shall verify that EQUIPMENT meet prescribed contractual requirements and are properly handled, identifiable, traceable, cleaned, preserved and stored.

i. Control of interface and interaction between the COMPANY and QA/QC services CONTRACTOR [Independent Inspection Agency(ies)].

j. Any other applicable QA/QC activity(ies) for the EQUIPMENT.

4. Design Control

a. All design input and output shall be reviewed prior to release to the next stage. In addition to design review, design verification shall be conducted to ensure that the design stage output meets the design stage input requirements.

b. MANUFACTURER shall ensure that all design computations, design drawings and other design documents are properly controlled and checked prior to submission to the COMPANY. Design documents shall be signed by the person(s) who prepared and checked them. COMPANY reserves the

right to return design documents without the proper signature of the responsible person(s).

5. Field Testing/Inspection and Construction/Installation Control

MANUFACTURER shall establish and document all procedures and WORK instructions to ensure that the erection and installation processes are performed in a controlled manner.

MANUFACTURER shall conduct inspection and testing activities of EQUIPMENT at all phases and quality audit at appropriate stages of the PROJECT(S) construction/installation.

C. Quality Control Plan/Inspection and Test Plan

1. The MANUFACTURER shall submit to the COMPANY the quality control plan/inspection and test plan for EQUIPMENT covered under purchase order(s).

The quality activities including but not necessarily limited to, inspection and testing, for the EQUIPMENT shall be planned and documented in the form of a quality control plan/inspection and test plan. The quality control plan/inspection and test plan shall be submitted to the COMPANY together with the EQUIPMENT Quality Plan/Quality Program.

2. The essential features of the required quality control plan/inspection and test plan are as follows:

a. It is specifically identified to a particular material/equipment.

b. It has provision for revisions to be made and is assigned a unique document number.

c. It lists all the inspection and testing activities sequentially.

d. It states the location at which the activity is to be carried out.

e. It identifies the applicable standard, test procedure to be followed and the acceptance criteria for the inspection or test activity.

f. It identifies the extent of inspection, sampling frequency and sample size, or extent of check.

g. It identifies the hold point, witness point and surveillance point.

h. It identifies the record document to be generated, reviewed and retained.

3. The quality control plan/inspection and test plan shall indicate the scheduled dates of testing and inspection at the designated location.

4. The MANUFACTURER shall arrange traveling requirements of COMPANY Personnel for witnessing factory manufacturing process, inspection and testing of EQUIPMENT, as per the requirements of section 3.27. The MANUFACTURER shall submit a schedule for factory inspection of EQUIPMENT after issuing request for manufacturing for COMPANY review.

5. Inspection and test plan is to be approved during EQUIPMENT preliminary design stage.

D. <u>Other Suppliers</u>

MANUFACTURER shall ensure that purchase order(s) are not re-assigned or sub-contracted to other manufacturers/suppliers without COMPANY'S written consent.

E. <u>Quality Assurance and Quality Control Services Contractor [Independent Inspection Agency]</u>

1. MANUFACTURER shall contract with COMPANY approved Quality Assurance and Quality Control Services CONTRACTOR(s) to provide Quality Control/Quality Assurance monitoring of all quality activities related to manufacturing of EQUIPMENT.

2. MANUFACTURER shall instruct the contracted Quality Assurance and Quality Control Services CONTRACTOR(s) to provide directly to COMPANY REPRESENTATIVE, by express mail or fax, four (4) copies of material status, quality surveillance reports, inspection and test reports within seven (7) days after the inspection. Soft copy of these singed reports in CD shall also be furnished and submitted for COMPANY records. All pages of the inspection and test reports shall be reviewed, signed and stamped by the approved inspector from the Quality Assurance and Quality Control Services CONTRACTOR.

3. MANUFACTURER'S Quality Assurance and Quality Control Services CONTRACTOR shall not re-assign or sublet portion of their contracted Quality Control/Quality Assurance monitoring WORK.

4. MANUFACTURER shall provide the COMPANY a copy of the scope of work issued to the Quality Assurance and Quality Control Services CONTRACTOR.

5. MANUFACTURER shall instruct the Quality Assurance and Quality Control Services CONTRACTOR to verify and check each material/equipment for conformance against the PROJECT(S) scope of work and technical specification and each clause of the applicable COMPANY Material Standard Specification (TMSS) and report all deviations that are not included in the COMPANY issued

clarifications. The report of the Quality Assurance and Quality Control Services CONTRACTOR shall include the following:

a. PROJECT title, CONTRACT number.

b. Complete description of the inspected material/equipment.

c. Report number and date.

d. Place and date of inspection, scope of inspection.

e. Documents used during inspection.

f. MANUFACTURER and plant location where the EQUIPMENT was manufactured.

g. Detailed description of the inspection and testing activities and their results, deviations to specification, MANUFACTURER'S explanation to the deviations, visual inspection result, packing and marking inspection result, conclusion and copy of the outline drawing of the inspected material/equipment. Witnessed tests and reviewed test data shall be clearly identified in the inspection reports.

h. Name and signature of the inspector(s).

6. MANUFACTURER shall furnish copies of the following document to the Quality Assurance and Quality Control Services CONTRACTOR(s) contracted to perform Quality Assurance and Quality Control monitoring of each material and equipment before surveillance:

a. Purchase order placed to the manufacturer/supplier.

b. Relevant section of PROJECT(S) scope of work and technical specification.

c. Applicable COMPANY developed standard and specification.

d. MANUFACTURER'S technical specifications and COMPANY approved design drawings.

e. COMPANY'S approval of material/equipment and applicable clarifications issued by the COMPANY.

f. COMPANY approved test program, manufacturing quality control plan or inspection and test plan.

7. MANUFACTURER shall send to the COMPANY, copy(ies) of all technical correspondence exchanged between MANUFACTURER and "Quality Assurance and Quality Control Services CONTRACTOR".

8. MANUFACTURER shall obtain approval from COMPANY before allowing any personnel of the Quality Assurance and Quality Control Services CONTRACTOR to perform Quality Assurance and Quality Control monitoring activities related to EQUIPMENT manufacturing. MANUFACTURER shall propose the names of the inspectors from the latest COMPANY Approval List. The specific material/equipment to be inspected, MANUFACTURER and location of manufacturing plant shall be identified for each proposed inspector of the Quality Assurance and Quality Control Services CONTRACTOR.

9. COMPANY has the right to hire third party to monitor the process of manufacturing, the MANUFACTURER shall provide all required facilities in the factory to accommodate the third party in order to facilitate his task.

F. <u>COMPANY's Quality Assessment (Audit) Right</u>

1. COMPANY reserves the right to conduct scheduled and/or unscheduled quality assessment of MANUFACTURER's Quality System and EQUIPMENT Quality Plan implementation. The results of such assessments (audits) shall be confidential between MANUFACTURER and COMPANY.

   MANUFACTURER shall provide all access and assistance in a timely manner to COMPANY personnel who will perform the quality assessment (audit).

   The MANUFACTURER shall implement corrective actions on all deficient areas discovered during the quality assessment (audit) within a mutually agreeable time frame. All costs (except cost of wages, transportation and lodging of COMPANY Quality Assessors) incurred during the quality assessment (audit) shall be borne by the MANUFACTURER.

2. COMPANY reserves the right to perform plant survey, quality assessment (audit), and quality surveillance activities and to inspect material at the MANUFACTURER'S facility to verify compliance with the terms and conditions of the purchase order(s) and its related documents. COMPANY reserves the right to witness any and all tests specified and to perform such visual examination (inspection) at the MANUFACTURER'S facility. COMPANY reserves the right to require certificates and data from the MANUFACTURER on any pertinent aspect of the manufacturing process, including but not limited to, mill test reports, heat treatment certificates, welders and welding procedure qualification records, non-destructive examination records, test records and quality control manual that will form part of the non-material requirement that shall be shipped to COMPANY as a document package.

3.11 TEST RECORD BOOK

The Quality Assurance and Quality Control Services Contractor shall send directly to the COMPANY a copy of "Test Record Book" for factory test report of EQUIPMENT.

MANUFACTURER shall send to the COMPANY a copy of "Test Record Book" for factory test report of EQUIPMENT.

3.12 FINAL AS-MANUFACTURED DRAWINGS

MANUFACTURER shall furnish two (2) complete set of all drawings (Hard and soft copy) to COMPANY, stamped as "Final As-Manufactured" within two (2) weeks after Factory Acceptance Testing (FAT) for the designated PROJECT.

The “Final As-Manufactured” Drawings shall incorporate all the comments raised during “Factory Acceptance Testing (FAT)” and in “As-Manufactured” drawings.

3.13 EQUIPMENT AS-BUILT DRAWINGS

MANUFACTURER shall coordinate with the COMPANY for final SITE marked drawings with SITE modifications. MANUFACTURER shall prepare “As-Built” drawings in sufficient details to present an accurate record for the COMPANY within two (2) weeks after the COMPANY has handover SITE marked drawings to the MANUFACTURER.

3.14 Power Transformer/Reactor Notification & PURCHASE ORDERS

EQUIPMENT will be requested through “**Power Transformer/Reactor Notification ”** that will be initiated by COMPANY for specific PROJECT(S), for which terms and conditions stipulated in this PURCHASE CONTRACT shall apply.

The “**Power Transformer/Reactor Notification ”** shall be considered accepted upon COMPANY receipt of the MANUFACTURER’s acknowledgment. However, if no exceptions are recorded by MANUFACTURER within seven (7) days of the order receipt, total acceptance of the order is acknowledged by MANUFACTURER without reservation or exceptions, whether or not MANUFACTURER has signed and returned the acceptance copy.

MANUFACTURER shall not commence the activities of the manufacturing of the ordered EQUIPMENT until the related “Purchase Order” has been issued by COMPANY.

However, MANUFACTURER may proceed with procurement of basic components which are unlikely to change based on COMPANY comments on MANUFACTURER’S submittal.

3.15 PROGRESS REPORTING

A. The MANUFACTURER shall submit EQUIPMENT monthly progress reports, in COMPANY approved formats (hard and soft copy) to the responsible COMPANY representative. For this purpose, the total WORK shall be divided into:

1. Engineering and Design.
2. Procurement/Manufacture/Fabrication, inspection and delivery of EQUIPMENT.
3. Supervision on EQUIPMENT installation.
4. Supervision on EQUIPMENT testing and commissioning.

B. The following information shall be included in the progress reports:

1. Percent of WORK completed as compared to the weighted schedule used to assess WORK progress.
2. Problem areas which can have an adverse effect on the schedule.
3. Supervisors and equipment availability against the schedule requirement.

C. The MANUFACTURER shall carry out planning/scheduling by using MS PROJECT computer software or other COMPANY approved software. All schedules shall be submitted in CD-ROM.

D. As found necessary by COMPANY, coordination meeting(s) for EQUIPMENT progress will be conducted between COMPANY, MANUFACTURER and SUBSTATION CONTRACTOR during the duration of the PROJECT(S) contract. The SUBSTATION CONTRACTOR will prepare the minutes of all meetings. The initial draft will be submitted by the SUBSTATION CONTRACTOR to the COMPANY representative and the MANUFACTURER representative for review and concurrence. The SUBSTATION CONTRACTOR will then incorporate the required corrections and submit to the COMPANY one (1) original and three (3) copies after they are duly signed by the authorized representatives of the MANUFACTURER and SUBSTATION CONTRACTOR. The COMPANY shall sign two (2) copies in acceptance and furnish one (1) to the MANUFACTURER and one (1) to the SUBSTATION CONTRACTOR and retain the original.

3.16 PACKING

Packing and shipping shall be in accordance with 01-TMSS-01.

3.17 RELEASE FOR SHIPMENT

1. "Release for Shipment Certificate" is a certificate issued by the COMPANY to the MANUFACTURER to release the described EQUIPMENT for shipment after COMPANY approval of the EQUIPMENT factory test report.

2. MANUFACTURER shall ensure that all material requiring inspection and/or quality surveillance at the MANUFACTURER'S facility are not shipped to the WORK SITE without a "Release for Shipment Certificate."

3. MANUFACTURER acknowledges that material shipped without approved "Release for Shipment Certificate" is subject to rejection and return at the MANUFACTURER'S expense.

4. MANUFACTURER shall ensure that all inspection and surveillance reports and any other requirements are satisfactorily completed before requesting the COMPANY to approve the "Release for Shipment Certificate."

3.18 EQUIPMENT DELIVERY

MANUFACTURER is responsible to arrange insurance, shipment, custom clearance, deliver and unloading the EQUIPMENT on the foundation at SUBSTATION SITE in Saudi Arabia. All cost at custom clearance, custom duties and fees of EQUIPMENT, to be borne by the MANUFACTURER.

The delivery schedule of EQUIPMENT to the SUBSTATION SITE will be (8-10) months from the date of "Purchase Order".

MANUFACTURER shall not ship the EQUIPMENT until "Release for Shipment Certificate" issued by COMPANY. This certificate will be considered as integral part of payment documents.

MANUFACTURER shall coordinate with COMPANY/SUBSTATION CONTRACTOR for the delivery schedule.

SUBSTATION CONTRACTOR will be responsible for construction of EQUIPMENT foundation at SUBSTATION SITE.

SUBSTATION CONTRACTOR will be responsible for storing all the loose materials/panels/relays in a safe place inside or near substation.

Due to reasons beyond COMPANY'S control, COMPANY can request MANUFACTURER to delay the shipment of EQUIPMENT by maximum three (3) months without any additional cost to COMPANY for shipment delay period and EQUIPMENT storage. In case, COMPANY requests to delay the shipment of EQUIPMENT more than three (3) months, a storage cost will be applicable to the COMPANY for extra delay days than the three (3) months.

3.19 RECEIPT INSPECTION

1. MANUFACTURER, SUBSTATION CONTRACTOR and COMPANY shall conduct receipt inspection of EQUIPMENT after delivery at PROJECT(S) SITE and during opening of EQUIPMENT packing. CONTRACTOR will repack the equipment under the supervision of the MANUFACTURER in case the EQUIPMENT foundation is not ready as per the committed schedule date.

   MANUFACTURER shall submit to COMPANY a document of EQUIPMENT Hand-Over to SUBSTATION CONTRACTOR. This document shall indicate PROJECT(S) information, purchase order reference, shipment certificate, time and date of handover and the status of EQUIPMENT packing with acknowledgement of SUBSTATION CONTRACTOR.

2. SUBSTATION CONTRACTOR will promptly report to the COMPANY for any shipment and transportation damage.

3.20 EQUIPMENT REPLENISH/REPLACEMENT

In case the EQUIPMENT or part of the EQUIPMENT is lost or damaged or failure during transit and/or erection/testing, the following action to taken:

Item	Event	Responsible	Action
1.	Damage During Shipment of the EQUIPMENT up to SUBSTATION SITE. OR Part of EQUIPMENT is Lost.	MANUFACTURER	- SUBSTATION CONTRACTOR will notify COMPANY of damage occurrences and attaching the verification report for documenting the case. - MANUFACTURER shall replenish the same without affecting PROJECT Schedule at no extra cost to COMPANY. - If delay in PROJECT schedule happen due to lost or damage, a delay penalty to be applicable.
2.	Damage During Installation	SUBSTATION CONTRACTOR;	- SUBSTATION CONTRACTOR will notify COMPANY of damage occurrences and attaching the verification report for documenting the case. - SUBSTATION CONTRACTOR will coordinate directly with MANUFACTURER to replenish the

Item	Event	Responsible	Action
			same and Cost (to be paid by SUBSTATION CONTRACTOR) shall be mutually agreed upon. - MANUFACTURER shall replenish the same without affecting PROJECT(S) schedule.
3.	Failure of EQUIPMENT During TESTING & COMMISSIONING	MANUFACTURER	- SUBSTATION CONTRACTOR will notify COMPANY of failure occurrences and attaching the inspection report for documenting the case. - MANUFACTURER shall replenish the same without affecting PROJECT(S) schedule at no extra cost to COMPANY. - If delay in PROJECT(S) schedule happen due to lost or damage, a delay penalty to be entitled by COMPANY.

3.20 TECHNICAL DATA MANUALS

The MANUFACTURER shall provide two (2) copies of EQUIPMENT technical data manuals installed for PROJECT(S).

The manuals binders shall have COMPANY logo, binder number and PROJECT(S) title, and CONTRACT number on the front cover.

3.21 COMMISSIONING, OPERATION AND MAINTENANCE MANUALS

A. The MANUFACTURER shall submit to the COMPANY commissioning, operation and maintenance manuals, along with pre-commissioning and procedures manuals, consisting of, as a minimum, the following documents:

1. Detailed MANUFACTURER'S instruction manuals applicable to each equipment installed. These manuals shall contain all information (including any special design and/or construction or operation feature) which may be required by the COMPANY for safe operation and maintenance of the new facilities and shall describe fully erection, commissioning, operation and maintenance procedures including mechanical/electrical tolerances for maintenance/repair purposes (Hard and soft copy).

2. MANUFACTURER'S instruction manuals applicable to each particular test apparatus (Hard and soft copy).

3. Complete sets of exploded view drawings with comprehensive parts identification for each device to enable the COMPANY to catalogue and order.

4. Interconnection and schematic diagrams.

5. Setting and calibration procedures and instructions.

6. Gasket Layout drawing showing the Size, Material and Location of each Gasket/O-ring.

B. The submission schedule for commissioning, operation and maintenance manuals as detailed in (A) above shall be as given below:

1. Six (6) sets for preliminary review by COMPANY as to adequacy, completeness, and legibility at least eight (8) weeks before commencing commissioning tests.

2. Four (4) complete sets of fully revised manuals original (original hard and soft copy and no photocopies) incorporating the COMPANY'S comments to the full satisfaction of the COMPANY before technical completion of the PROJECT(S).

3.22 SPECIAL TOOLS/TEST EQUIPMENT

MANUFACTURER shall provide and deliver to COMPANY designated warehouse new special tools/test equipment as ordered by COMPANY. However, general and SITE testing equipment for installation, testing and commissioning will be provided by SUBSTATION CONTRACTOR.

MANUFACTURER shall arrange insurance coverage of all special tools/test equipment up to the WORK SITE to the final destination.

All cost at custom clearance, custom duties and fees of special tools/test equipment to be borne by the MANUFACTURER.

These special tools shall be supplied by MANUFACTURER, only after confirmation by COMPANY through written order(s) during duration of PURCHASE CONTRACT.

Type/Model/Make of special tools indicated by the COMPANY/SUBSTATION CONTRACTOR is tentative only. Correct type/model/make against each item of shall be supplied, based on drawings approved by COMPANY.

MANUFACTURER shall provide/use his own tools/test equipment's that are required for testing and commissioning the equipment at SITE. MANUFACTURER shall be responsible for the insurance of his tools.

For More details, refer to **Appendix-6**.

3.23 START-UP SPARE PARTS

MANUFACTURER shall deliver start-up spares along with EQUIPMENT complying with COMPANY specifications and standards. However, all components required for successful commissioning of the supplied EQUIPMENT due to failures/defects noticed shall be replaced by MANUFACTURER.

MANUFACTURER shall submit technical data sheet as per latest COMPANY format for start-up covered under this PURCHASE CONTRACT for COMPANY approval before procurement. These details shall also be accompanied by catalogue cuts and drawings and/or extracts from O&M Manuals indicting details of each spare part.

3.24 OPERATIONAL SPARE PARTS

MANUFACTURER shall provide and deliver to COMPANY designated warehouse(s) in Saudi Arabia operational spares complying with COMPANY specification as per schedule "C".

MANUFACTURER shall arrange insurance coverage of all operational spare parts up to the final destination.

All cost at custom clearance, custom duties and fees of operational spare parts to be borne by the MANUFACTURER.

These operational spare parts shall be supplied by MANUFACTURER, only after confirmation by COMPANY through written order(s) during duration of PURCHASE CONTRACT.

MANUFACTURER shall provide details of operational spare parts within sixty (60) days from the date of this PURCHASE CONTRACT in COMPANY prescribed format along with complete technical details/catalogue. This timely submittal is essential for COMPANY to confirm the requirement of spare parts as per the stipulated time.

The parts data package shall include the following.

- All required data by COMPANY and cross references (Part No., Designation No., Drawing and Position No., Model No., Catalog No., Communication No., Product Code No., etc.) of spare parts of equipment and for each sub-assembly or auxiliary equipment that is identified by a unique model number or serial number.

- A complete bill of materials with appropriate drawings illustrating and identifying all parts/components in their respective positions on each item of equipment.

- MANUFACTURER'S list of all interchangeable parts/components if any, between MANUFACTURER'S equipment.

Type/Model/Make of spare parts indicated by COMPANY are tentative only. Correct type/model/make against each item of spare parts shall be supplied based on drawings approved by COMPANY. As per MANUFACTURER indicate that an item of spare parts is Not Applicable (N/A), MANUFACTURER shall be verified.

For more detail, refer to **Appendix-5**.

3.25 TRAVELING REQUIREMENTS

The Manufacturer shall provide round trip transportation/airfare, accommodations and food for the selected COMPANY personnel that will participate in the different activities as indicated on the relevant sections of this SOW/TS, based on the following minimum requirements:

1. For the airfare transportation requirements, Manufacturer shall provide IATA (International Air Transport Association) standard business class round-trip airfare tickets from international Airport in Saudi Arabia to the activity's locations.
2. For the ground transportation requirements, to/from activities locations to hotels/airports/restaurants which participants will be utilizing as well as for ground transportation from participants homes locations to Airports, the Manufacturer shall provide ground transportation through use of established and reputable taxi/limousine services for these COMPANY personnel.
3. For accommodations portion, Manufacturer shall provide accommodations for the COMPANY selected participants in either five stars, or four stars hotels if five-star hotels are not available in/near the city of the activities. Also, each COMPANY participant shall be provided with both breakfast and dinner ("buffet style") and unlimited Wi-Fi connection for the entire duration of hotel stay. Manufacturer shall provide a buffet style Halal lunch either at activities locations/facilities, or at a hotel/restaurant for each of the COMPANY participants for the entire duration stay.
4. Manufacturer shall provide flight tickets and hotel reservation to the COMPANY personnel at least three (3) weeks before the scheduled flight for proper coordination.
5. International phone calls (within 20 minutes/day), internet/mobile Data (3GB/day), laundry services, water & juices shall be provided for COMPANY Personnel.
6. Additionally, the Manufacturer shall be responsible for obtaining the necessary entrance VISA to the country (or countries) of the activities, locations and the Manufacturer shall pay the required entrance VISA, VISA application fees, and accommodation and transportation required to issue VISA for each COMPANY participant.

3.26 TECHNICAL ADVISORY SERVICES

Installation, testing and commissioning work of EQUIPMENT shall be borne by SUBSTATION CONTRACTOR under direct MANUFACTURER supervision.

MANUFACTURER shall provide complete SITE installation, testing and commissioning procedures for the EQUIPMENT supplied to SUBSTATION CONTRACTOR one (1) month before shipment as per COMPANY specifications/requirements.

The duration of supervision of Installation, testing and commissioning as per COMPANY specifications and requirements is twenty five (25) working Man-days for one (1) power transformer EQUIPMENT. In the supervision duration, involving numbers of trips of supervisors as required, cost of MANUFACTURER' supervisor(s) including air ticket to PROJECT SITE and back, VISA, insurance, food and accommodation, local transportation from Hotel to Job site and back shall be arranged and borne by MANUFACTURER.

SUBSTATION CONTRACTOR will intimate and notify MANUFACTURER three (3) weeks in advance the supervision schedule and the required date of supervisor availability at PROJECT(S) SITE and MANUFACTURER shall arrange accordingly and obligate to this supervision schedule.

WORKING HOURS:

During the construction phase of the PROJECT, MANUFACTURER shall work during the normal working hours of the COMPANY, i.e. 7:00 AM to 3:00 PM unless otherwise instructed by the COMPANY. The MANUFACTURER shall coordinate with the COMPANY to get Access Permit to PROJECT(S) SITE before commencing the job. The MANUFACTURER shall coordinate with the SUBSTATION CONTRACTOR for performing supervision work.

3.27 TRAINING REQUIREMENTS

FACTORY TRAINING:

MANUFACTURER shall submit training program for COMPANY review and approval.

MANUFACTURER shall arrange factory training complete with all required instructional materials complying with COMPANY requirements as per Appendix-III.

Training session(s) shall be arranged by MANUFACTURER, only after confirmation by COMPANY through a written notice during PURCHASE CONTRACT duration.

MANUFACTURER shall provide travelling requirements for COMPANY personnel as specified in section 3.26.

SITE TRAINING:

SITE demonstration during installation, testing and commissioning shall be conducted by MANUFACTURER supervisor(s).

3.28 WARRANTY

a) The EQUIPMENT/MATERIALS to be supplied shall be fit for the purpose intended, free of defects in design, engineering, materials or workmanship and conform to the standards/specifications contained in this PURCHASE CONTRACT.

b) MANUFACTURER shall provide warranty certificate for the EQUIPMENT to be supplied against any defects arising out of faulty design/engineering, defects in material or workmanship/manufacturing for a period of eighteen (18) months from the date of delivery or twelve (12) months from EQUIPMENT technical completion, whichever comes first. In addition, warranty requirements specified in the pre-qualification conditions to be applied to related MANUFACTURER.

c) If at any time prior to or within the warranty period, COMPANY found the EQUIPMENT to be defective, MANUFACTURER shall repair or provide replacement of the same on priority to the full satisfaction of COMPANY without any cost added to COMPANY. Should MANUFACTURER refuse to undertake the corrective work, then COMPANY has the right to perform or have others perform some or all of the corrective work at MANUFACTURER'S expense.

d) If, pursuant to the above, MANUFACTURER/COMPANY performs any corrective work, the warranty set forth above shall apply to such corrective work and any materials or equipment provided by MANUFACTURER/COMPANY for a period of twelve (12) months from the actual date of preliminary acceptance of corrective work.

e) The warranty certificate from MANUFACTURER in original (in MANUFACTURER'S Original Letterhead) shall be furnished by MANUFACTURER after completion of delivery.

f) MANUFACTURER'S liability under this warranty does not extend to defects caused by vandalism, improper installation/operation/maintenance.

END OF SECTION 3

SECTION 4 SCOPE OF WORK

4.1 GENERAL

The MANUFACTURER shall design, engineer, manufacture, factory test, supply and supervise installation, testing and commissioning of Power Transformers EQUIPMENT complete with all accessories along with all associated work and services in a satisfactorily manner as specified in this scope of work and technical specifications, whether specifically mentioned/specified in detail or not shall be supplied as necessary.

4.2 TRANSFORMER EQUIPMENT & FACILITIES

A. 50/67MVA, POWER TRANSFORMERS

Design, engineer, manufacture, factory test, supply and supervise installation, testing and commissioning of 50/67MVA, ONAN/ONAF, 3-phase, 60 Hz., oil immersed power transformers with OLTC, HV outdoor bushings & MV cable boxes (LV with XLPE cable to air bushing and MV cable box shall be suitable for 6-630mm² per phase or LV Bus, as applicable), brackets for mounting surge arresters, complete with bushing CTs, all appurtenances and accessories.

1. The power transformer shall be one of the following types as detailed in the drawings and data schedules attached with this PTS:

   a) TR67-YNyn0+d1-132:

   50/67MVA, 132/13.8kV, YNyn0+d1, X/R ≤ 58, 22% @ 50MVA and OLTC -20% to +12.5%.

   b) TR67-YNyn0+d1-110:

   50/67MVA, 110/13.8kV, YNyn0+d1, X/R ≤ 58, 22% @ 50MVA and OLTC -20% to +12.5%..

   c) TR67-Dyn1-132:

   50/67MVA, 132/13.8kV, Dyn1, X/R ≤ 58, 22% @ 50MVA and OLTC -20% to +12.5%.

   d) TR67-Dyn1-115:

   50/67MVA, 115/13.8kV, Dyn1, X/R ≤ 58, 22% @ 50MVA and OLTC -20% to +12.5%.

2. Stabilizing winding (if applicable) shall be determined by the MANUFACTURER with calculations based on dynamic short circuit withstanding capability. The rating

shall be guaranteed by the manufacturer and **shall be at least one-third (1/3) of the power rating of the secondary winding as per clause 4.3.7 of 53-TMSS-01.**

The voltage rating of the stabilizing winding (if applicable) shall be 6.6kV having the BIL rating of minimum $60kV_{peak}$.

Tertiary stabilizing windings shall be open Delta connection. The two terminal of the open corner shall be brought outside through two outdoor bushings and shorted externally. Moreover, the same shall be brought to the bottom of the Power Transformer through grounding leads/bars as per clause 4.21 of 53-TMSS-01 Rev.02.

3. The power transformer grounding shall be as follows:

<u>HV Side:</u>

The transformers with "Y" connection at HV shall be solidly grounded. The HV winding can be either uniform or graded insulated. The BIL of the graded HV winding (if applicable) shall be minimum $170kV_{peak}$.

<u>MV Side:</u>

The MV side grounding shall be either one of the following types:

i. Solidly grounding.

ii. Grounding through neutral grounding resistor (NGR; which shall be provided by the substation CONTRACTOR).

4. The power transformer shall be provided with the following bushing CTs as detailed in the drawings and data schedules attached with this PTS:

a) <u>Metering CTs:</u>

CT #	Ratio [A/A]	Class	Burden [VA]
LV Bushing CT (Only on 'y' Phase)			
CT-1	2803 / 1	0.5	30

Winding temperature indicator (WTI) CT shall be decided by MANUFACTURER.

b) <u>Protection CTs:</u>

- Refer to **Appendix-3**.

5. Note that the total guaranteed ONAN losses shall not exceed 209 kW.

B. 80/100MVA, POWER TRANSFORMERS

Design, engineer, manufacture, factory test, supply and supervise installation, testing and commissioning of 80/100MVA, ONAN/ONAF, 3-phase, 60 Hz., oil immersed power transformers with OLTC, HV outdoor bushing & LV cable boxes (LV with XLPE cable to air bushing and LV cable box shall be suitable for 3-1000mm² per phase), brackets for mounting surge arresters, complete with bushing CTs, all appurtenances and accessories.

1. The power transformer shall be of the following rating as detailed in the drawing and data schedule attached with this PTS:

TR100-YNyn0+d1-132:

80/100MVA, 132/33kV, YNyn0+d1, X/R ≤ 50, 14% @ 80MVA and OLTC -15% to +10%.

2. Stabilizing winding shall be determined by the MANUFACTURER with calculations based on dynamic short circuit withstanding capability. The rating shall be guaranteed by the manufacturer and **shall be at least one-third (1/3) of the power rating of the secondary winding as per clause 4.3.7 of 53-TMSS-01.**

The voltage rating of the stabilizing winding shall be 13.8kV having the BIL rating of minimum $95kV_{peak}$.

Tertiary stabilizing windings shall be open Delta connection. The two terminal of the open corner shall be brought outside through two outdoor bushings and shorted externally. Moreover, the same shall be brought to the bottom of the Power Transformer through grounding leads as per clause 4.21 of 53-TMSS-01 Rev.02.

3. The power transformer grounding shall be as follows:

HV Side:

The transformers with "Y" connection at HV will be solidly grounded. The HV winding can be either uniform or graded insulated. The BIL of the graded HV winding (if applicable) shall be minimum $170kV_{peak}$.

MV Side:

The LV side grounding shall be either one of the following types:

i. Solidly grounding.

iii. Grounding through neutral grounding resistor (NGR; which shall be provided by the substation CONTRACTOR).

4. The power transformer shall be provided with the following bushing CTs as detailed in the drawings and data schedules attached with this PTS:

a) Metering CTs:

CT #	Ratio [A/A]	Class	Burden [VA]
LV Bushing CT (Only on 'y' Phase)			
CT-1	1750 / 1	0.5	30

Winding temperature indicator (WTI) CT shall be decided by MANUFACTURER.

b) Protection CTs:

- Refer to **Appendix-3**.

5. Note that the total guaranteed ONAN losses shall not exceed 254kW

C. General Requirements for All Power Transformers

The following requirements shall be specifically complied with for Power Transformers.

a) General

The power transformers shall be equipped with **Vacuum Coarse fine** On Load Tap Changer (OLTC) located at the HV winding and suitable for operating with Remote Tap Changer Control Panel (RTCC) to be supplied by others. The step voltage for the taps shall be 1.25%.

The full capacity of the power transformer shall be available at all positions of the tap. The OLTC and all other current carrying accessories shall be rated for 120% of the current corresponding to highest current tap.

OLTC shall be provided with an over-current blocking device to stop the motor-drive mechanism of the On Load Tap Changer from operating when the transformer load current exceeds a pre-set overload limit as specified in the clause 5.7.3 of IEC 60214.2.

b) The detail of the location of CT's for winding temperature indicators shall be furnished to the COMPANY for review and approval.

c) The power transformers oil in all respect shall be as per 54-TMSS-01.

d) Online Gas Analyzer is not required under this Contract. However, Power Transformers shall be design to have the required provision to the same for future use.

e) Power Transformers with outdoor HV Bushings shall be provided with 96, 108 or 120 kV; as applicable outdoor, station class, metal-oxide Surge Arresters that to be mounted on the designated power transformers brackets.

f) During shipment, each power transformer tank shall be fitted with two (2) impact recorders, each one capable of measuring the impact in three (3) directions. Downloading of impact recorder Recordings shall be done at National Grid SA designated office. It shall be the MANUFACTURER's responsibility to provide necessary interface hardware/software for the same.

   The type of impact recorder to be fixed on the power transformer tank while transporting per 5.2 of 53-TMSS-01 is subject to National Grid SA approval.

   In case of any defect/failure of impact recorder during transit, National Grid SA may ask the MANUFACTURER to give extended warranty period. Therefore, extra care shall be exercised for installing the correct impact recorder.

   MANUFACTURER shall submit catalogue copies of proposed impact recorder for National Grid SA review and approval.

g) The optical fiber sensors for hot spot measurements of the power transformer as per 4.6.3 of 53-TMSS-01 shall be provided and terminated in power the transformer LCC.

h) As per clause 4.6.3.f of 53-TMSS-01, Fiber optic sensors shall be provided with monitoring system. The system shall be fully integrated with SAS at bay level using IEC 61850 and also at station level integration with the HMI for analyzing purposes. Monitoring system software shall be compatible with all SAS Software's. This monitoring system shall support PRP.

i) MANUFACTURER shall design the power transformers with wheel moving facilities which can be detached at SITE and used as SKID type base power transformers based on SITE conditions.

j) MANUFACTURER shall arrange to ship sufficient quantity of oil including wastage/contingency to avoid any delay in SITE activities.

k) The MV cable box shall be at 3 o'clock position when facing HV bushings.

l) To connect Power Transformer to substation MV Switchgear, MV cable box shall be designed to Accommodate either:

i. Six (6) cable per phase (6x1Cx630mm2, Cu conductor, supper clean XLPE for 50/67 MVA Power Transformers or 3x1Cx1000mm2, Cu conductor, supper clean XLPE for 80/100 MVA Power Transformers).

m) In case Condenser bas bar connections is required, MV cable box shall be designed to connect Power Transformer to substation MV Switchgear through MV Fully Insulated Condenser Bus Bars & Associated accessories.

i. One (1) Lot: Outdoor/indoor Condenser Busbars comprising insulated Bus Bars suitable for MV, 3600A/2500A, 60Hz 25kA/1 sec per phase as per 32-TMSS-08, connecting MV side of Power Transformers with the compartment of MV, 3600A/2500A, Transformer Incomer Switchgear Panels complete with termination assembly, hardware and accessories.

n) The cantilever strength of all the bushings shall be as per IEC 60137.

o) The COMPANY may request the MANUFACTURER for the following:

i. To provide the power transformer(s) HV side with HV cable box (HV with XLPE cable to oil bushing), complete with bushing CT's, all appurtenances and accessories. The HV cable box shall be suitable for
1.1-400mm² per phase for 50/67MVA power transformer(s).
2.1-630mm² per phase for 80/100MVA power transformer(s).

ii. For power transformer(s) to be installed in locations with elevation higher than 1000m up to 3000m (if applicable), the power transformer(s) accessories (including bushing dimensions), shall be properly designed to meet the specific environment requirements.

iii. All parts of Control Cabinet panels shall be accessible. Otherwise staircase ladder shall be provided.

p) Power Transformer Tests

Type, Routine and special Test shall be carried out on the Power Transformers under this purchase contract as follow:

i. Type Tests, as per 53-TMSS-01, shall be carried out only on one representative unit for each type of Power Transformer under this Purchase Contract.

ii. Routine Tests, as per 53-TMSS-01, shall be carried out on all Power Transformers under this Purchase Contract.

iii. All Special Tests listed under clause 6.3.1 of 53-TMSS-01, shall be carried out on all Power Transformers under this Purchase Contract. All other special tests required per IEC/ANSI shall be carried out only on one representative Power Transformer unit for each type of Power Transformer under this Purchase Contract.

4.3 HV SHUNT REACTOR EQUIPMENT & FACILITIES

A. 132KV, BUS SHUNT REACTORS

Complete 132kV Bus Shunt Reactor(s), **40 MVAR** shall be supplied, including all bushings, bushing current transformers, monitoring sensors/ devices and other accessories.

S/NO.	SPECIFICATION	RATING	UNITS	REMARKS
1.	Ambient Temperature	55ºC		Outdoor
2.	Short Circuit Current Rating	40	kA	
3.	Bushings	OIL/XLPE OIL/AIR OIL/SF6		
4.	Frequency	60	Hz	
5.	Neutral Grounding	Solidly		

B. SHUNT REACTORS DESIGN CRITERIA

Shunt Reactors shall be design with following criteria

a) The CONTRACTOR shall conduct suitable studies to design. Reactors shall have non-linear windings with a minimum ‘k factor’ of 1.4 of magnetic flux linkage peak value (p.u).confirming to COMPANY & relevant IEC/IEEE Standards

b) The bushing of the Shunt Reactors shall be designed for a higher BIL rating. CONTRACTOR shall provide calculation to prove the adequacy of the BIL rating.

c) Substation Contractor shall carry out the OVER VOLTAGE studies as defined in insulation coordination study requirements. Manufacturer shall coordinate with contractor for this study to ensure that reactor design is in line with the results.

d) Reactor manufacturer shall check that equipment must not fail due to high frequency (0.2 MHz – 2 MHz), resonance, ferro-resonance etc.

e) All parts of Control Cabinet panels shall be accessible. Otherwise staircase ladder shall be provided.

f) MANUFACTURER shall coordinate with CONTRACTOR for above mentioned design/studies.

4.4 PROTECTION REQUIREMENTS

Refer to Appendix-3.

4.5 CONTRACT DESIGN DOCUMENTS, CALCULATIONS AND DRAWINGS

The MANUFACTURERS shall submit all design documents, calculations, studies and drawings at various stages of the CONTRACT as per **Table 4.01 below**, as a minimum:

Table 4.01

SECTIONS	S/N	Documents	TRANSFORMER PURCHASE CONTRACT			DURING CONSTRUCTION STAGE	
			Bid Stage	Preliminary Design	Final Design	As Manufactured Stage	As Built Stage
A. COMPLIANCE STATEMENT	A.1	PTS Compliance Statement	X	X	X		
	A.2	01-TMSS-01	X	X			
	A.3	31-TMSS-06		X			
	A.4	53-TMSS-01	X	X	X		
	A.5	54-TMSS-01	X	X	X		
B. DATA SCHEDULE	B.1	31-TMSS-06		X			
	B.2	35-TMSS-01		X	X	X	
	B.3	53-TMSS-01	X	X	X	X	
	B.4	54-TMSS-01	X	X	X		
	B.5	58-TMSS-01	X	X	X	X	
C. CALCULATIONS & TECHNICAL DATA	C.1	Short Circuit Calculation		X	X		
	C.2	Transformer Hot Spot Temperature & Aging		X	X		
	C.3	Thermal Damage Curve		X	X		
	C.4	Through Fault Withstand Curve		X	X		
	C.5	Inrush Current Curve		X	X		
	C.6	Over excitation Curve		X	X		

DESCRIPTION
NO. 1 2 3
REVISIONS
DEPARTMENT
ENGINEERING & DESIGN
PREPARED BY
Project Engineers
KUMAIL N. AL-FASHKHI
DATE: 15 / 08 / 2024
APPROVED BY
Group Leader
KHALIL I. AL-HANOUN
DATE: 15 / 08 / 2024
CERTIFIED BY
E&DD-EOA DIVISION MANAGER (A)
AMEEN H. AL-HULAIMI
DATE: 15 / 08 / 2024

SECTIONS	S/N	Documents	TRANSFORMER PURCHASE CONTRACT			DURING CONSTRUCTION STAGE	
			Bid Stage	Preliminary Design	Final Design	As Manufactured Stage	As Built Stage
	C.7	Overloading Curve/Calculation at ambient temperature		X	X		
	C.8	BH Curve of proposed core material from core MANUFACTURER & overflowing capability of core indicating the saturation value.		X	X		
	C.9	Cooling System Details and Calculations		X	X	X	
	C.10	Transformer/reactor Grounding Details		X	X	X	
	C.11	AC/DC Load requirements for Transformer/reactor and accessories		X	X	X	
	C.12	Technical details for Impact Recorder.		X		X	
D. DRAWINGS & CATALOGS	D.1	Drawing Control Sheet		X	X	X	X
	D.2	Abbreviation, Symbols & Legend		X	X	X	X
	D.3	Detail Transformer/Reactor & Accessories Outline Drawings		X	X	X	X
	D.4	Rating Plate drawing with Protection & Metering CTs details.		X	X	X	X
	D.5	AC/DC Power & control schematic diagram for Transformer/Reactor and Accessories.		X	X	X	X
	D.6	Foundation Detail for Transformer & Reactor		X	X	X	
	D.7	Shipping Drawing		X	X	X	

SECTIONS	S/N	Documents	TRANSFORMER PURCHASE CONTRACT			DURING CONSTRUCTION STAGE	
			Bid Stage	Preliminary Design	Final Design	As Manufactured Stage	As Built Stage
	D.8	Detail Valve Location Plate		X	X	X	
	D.9	OLTC Catalogue		X	X		
	D.10	Accessory Catalogues		X	X		
E. Test Plan & Procedure	E.1	QA/QC Plan	X	X			
	E.2	Type Tests Report for Transformer/Reactor & OLTC	X	X			
	E.3	Inspection Test Plan Type Tests		X			
	E.4	Inspection Test Plan Routine Tests		X			
	E.5	Site Test Procedure		X			
	E.6	Painting Procedure & Specification		X			
	E.7	Sub supplier List		X		X	
	E.8	Technical Data Manuals			X	X	

Notes for the Above Table:

1. Drawing control sheets shall be provided at every stage.
2. All design documents/calculations shall be provided in PDF format, along with the other requirements mentioned in PTS SOW/TS, at every stage.
3. All Drawings shall be provided in Microstation and PDF formats, along with the other requirements mentioned in PTS SOW/TS, at every stage.
4. All calculations, studies, reports, drawings/sheets, MANUFACTURER/Vendor drawings/sheets shall be given standard National Grid SA drawing numbers and format in accordance with SEEDS-II and the same shall be included in the drawing control sheet as part of Project drawings/calculations.
5. “As-Manufactured” and “As-Noted” drawings shall be submitted to SUBSTATION CONTRACTOR for incorporating field changes.
6. As-built drawings shall incorporate all the field changes (SUBSTATION CONTRACTOR will provide the mark up for field changes).

7. As built drawings are required as per "Engineering Drawing Standard" SEEDS-II.

4.6 STANDARDS, CODES AND SPECIFICATIONS

All WORKS equipment and material covered by this document shall conform to the latest edition of the COMPANY'S Material Standard Specifications supplemented with latest applicable industry standards, codes and specifications. The latest edition of each standard and specification shall mean the latest edition specified hereunder.

The CONTRACTOR shall strictly comply with the following standards, codes and specifications, and no deviation shall be accepted unless otherwise accepted by a written waiver from COMPANY. The CONTRACTOR may propose "equivalent" standards and specifications if such standards and specifications are equal to or better than those specified herein, and shall be subject to prior approval of the COMPANY.

#	Std/Sepc. No.	Title/Description
A.	**Saudi Arabian Standards**	
	SASO 39/1978	Mechanical Test of Welded Joints
	SASO/SSA-53	Graphic Symbols
B.	**COMPANY Materials Standard Specifications**	
	01-TMSS-01	GENERAL REQUIREMENTS FOR ALL EQUIPMENT/MATERIALS
	31-TMSS-06	TERMINAL BLOCKS
	35-TMSS-01	SURGE ARRESTER
	53-TMSS-01	POWER TRANSFORMERS RATED ABOVE 2.5 MVA
	58-TMSS-01	OIL IMMERSED REACTOR, 33 KV THROUGH 380 KV
	54-TMSS-01	MINERAL INSULATING OIL FOR ELECTRICAL APPARATUS
	Note: All blanks on the data schedules (given in Appendix-II), Inquiry Information (for TMSS) shall be properly filled-up by the MANUFACTURER (as required) without omission and shall be submitted as part of the MANUFACTURER technical proposal.	
C.	**COMPANY Engineering Standards**	
	TES-H-107.01	Painting Standards
	TES-H-107.02	Paint Color Codes and Standards

#	Std/Sepc. No.	Title/Description
	TES-P-119	Substation Design Standards
	TES-W-109.01	General Welding Criteria
	TES-S-101.01	Safety and Security Standards
D.	**COMPANY Construction Standards**	
	TCS-P-105	Pre-Commissioning Tests/Procedures for COMPANY Transmission Electrical Installations
E.	**Other Standards**	
	SEEDS-II	Saudi Electricity Company Engineering Drawings Standard for Preparing, Processing and Managing Transmission Drawings/Documents

END OF SECTION 4

SECTION 5 DESIGN CRITERIA

The MANUFACTURER shall adopt the design criteria indicated below as a minimum for this purchase contract.

5.1 ENVIRONMENTAL CONDITIONS

All equipment, materials, devices and their specified ratings furnished under this PROJECT shall be suitable for operation as outlined in TES-P-119.02 and 01-TMSS-01.

5.2 ELECTRICAL DESIGN REQUIREMENTS

A. General

1. The system design parameters shall be in accordance with the requirements outlined in COMPANY Standard TES-P-119.02 and hereunder:

   a. The short circuit rating of 132 kV or 115 kV or 110kV systems is 40kA for one (1) sec. (Sym.).
   b. The short circuit rating of the 33kV system is 25kA for one (1) sec. (Sym.).
   c. The short circuit rating of the 13.8kV system is 25kA for one (1) sec. (Sym.).

2. Computer Calculations

   If computer software is used in design calculations/studies, then the details regarding the name of the software, its version etc. shall be clearly indicated in the corresponding submittals and shall be accompanied by soft copy of the input and output files. Assumptions made (if any) shall be clearly highlighted with appropriate justification/supporting document for the assumed values. The data provided to the computer as an input shall be clearly distinguished from those computed by the program. A program description document (user's guide) and a copy of the software (on returnable basis) shall be made available upon request by the COMPANY and shall contain the information necessary to determine the nature and extent of the analysis, verify the input data, interpret the results, and determine whether or not the computations comply with these recommendations.

B. Auxiliary Supply Voltage

Description	Voltage
Supply Voltage for DC System	125V DC (Ungrounded)
Supply Voltage for Auxiliary Circuits	400/230V AC, 3Ø, 4 wire

END OF SECTION 5

SECTION 6 EQUIPMENT/MATERIALS & TECHNICAL SPECIFICATIONS

6.1 GENERAL

This section outlines broadly the technical specifications of the major equipment/materials required for this CONTRACT. The specifications outlined herein shall be read in conjunction with the attached CONTRACT drawings, the COMPANY Material Standard Specifications and the associated international standards and codes. The ratings and specific requirements of the various electrical equipments shall be as indicated in data schedule of COMPANY Material Standard Specifications, and the MANUFACTURER shall ensure full conformity with the same.

6.2 ELECTRICAL EQUIPMENT

All equipment/materials shall conform to the related COMPANY standards and other standards in accordance with the tabulation hereunder (Table 6.01):

Table 6.01

Serial No.	EQUIPMENT/MATERIAL	COMPANY Standards/ Other Standards
1.	132/13.8kV, 50/67 MVA Power Transformers 115/13.8kV, 50/67 MVA Power Transformers 110/13.8kV, 50/67 MVA Power Transformers	53-TMSS-01
2.	132/33kV, 80/100 MVA Power Transformers	53-TMSS-01
3.	132kV, 40MVAR Bus Shunt Reactor	58-TMSS-01
4.	Transformer Oil	54-TMSS-01
5.	Terminal Blocks	31-TMSS-06
6.	Surge Arrester	35-TMSS-01

Notes:

1. Power Transformers/Reactors

   a. Design Parameters

      i. Power transformers/Reactors shall conform to the additional requirements per attached data schedules.

      ii. The power transformer shall be equipped with an on-load tap changer (OLTC), which shall be derived by the remote tap changing controller (RTCC) through IED located in transformer bay control panel and all functions of tap changer control will be integrated with SAS. Moreover, contacts of oil gas/surge relay for OLTC, contact of pressure relief

device (main tank & OLTC), contacts of oil temperature indicator, winding temperature indicator, buchholz relay, oil level indicator (main tank & OLTC) and other power transformers accessories shall be compatible with SAS (control IEDs, annunciation IEDs and Protection IEDs).

iii. Alarms of power transformers mechanical protection, if any, will also be integrated with SAS.

END OF SECTION 6

SECTION 7 SUPERVISION OF EQUIPMENT INSTALLATION, SITE TESTING AND COMMISSIONING

7.1 TRANSFORMER & REACTOR EQUIPMENT

A. MANUFACTURER shall provide complete site installation, testing and commissioning procedures for the Transformers to COMPANY/SUBSTATION CONTRACTOR in accordance with COMPANY testing and commissioning procedure (TCS-P-105). Site installation, testing and commissioning procedures for the power transformers shall be subject to COMPANY review and approval.

B. MANUFACTURER shall supervise EQUIPMENT installation, site testing and commissioning of power transformers EQUIPMENT and related facilities.

C. The SUBSTATION CONTRACTOR will be responsible for providing temporary AC and DC power supplies needed to perform the commissioning and site tests. All tests shall be performed in accordance with the applicable IEC and ANSI Standards and established practices and procedures.

END OF SECTION 7 & SOW/TS

APPENDICES

FOR SCOPE OF WORK & TECHNICAL SPECIFICATIONS

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APPENDIX-1

DRAWING CONTROL SHEET & DRAWINGS

APPENDIX-H

DRAWING CONTROL SHEET

الشركة الوطنية لنقل الكهرباء نقل الكهرباء National Grid SA

PROJECT TITLE	PROJECT MANAGER / ENGINEER	CODES		CONTRACT NO. :	DRAFTING OFFICE
PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS	ALI M. AL-SAIHATI	S/S	OHTL - U/G	SAP NO. (JOB ORDER) :	EDD-EOA/PSU
SAUDI ARABIA				NUMBER OF DRAWINGS SPECIFY ON THIS SHEET : (19)	

PREFIX	DRAWING NO.	SHEET NO.	INITIAL REV. NO.	DRAWING TITLE	FURTHER REV.		REMARKS
					NO.	DATE	
				INDEX-A			
PTS	24CM1046		0	SCOPE OF WORK AND TECHNICAL SPECIFICATIONS WITH APPENDICES ATTACHED			
CT	926694	01 OF 01		SPARE			
				INDEX-P			
CT	926695	01 OF 01	0	ONE LINE DIAGRAM TR67-YNyn0+d1-132			
CT	926696	01 OF 01	0	ONE LINE DIAGRAM TR67-YNyn0+d1-110			
CT	926697	01 OF 01	0	ONE LINE DIAGRAM TR67-Dyn1-132			
CT	926698	01 OF 01	0	ONE LINE DIAGRAM TR67-Dyn1-115			
CT	926699	01 OF 01	0	ONE LINE DIAGRAM TR67-YNyn0+d1-132			
CT	926700		0	SPARE			
	TO						
CT	926712		0	SPARE			

AS BUILT BY		PROJECT COMPLETION DATE	PLANT NO.	INDEX	DRAWING NO.	REV. NO.	SHEET NO.
			NG2150	X	CT-926693	0	01 OF 01

REVISION COLOR CODE	Rev.01	Rev.02	Rev.03	Rev.04	Rev.05	Rev.06	Rev.07	Rev.08	Rev.09	Rev.10	Rev.11	Rev.12

`

DMS **EXCEL**

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926695	01 of 01	00

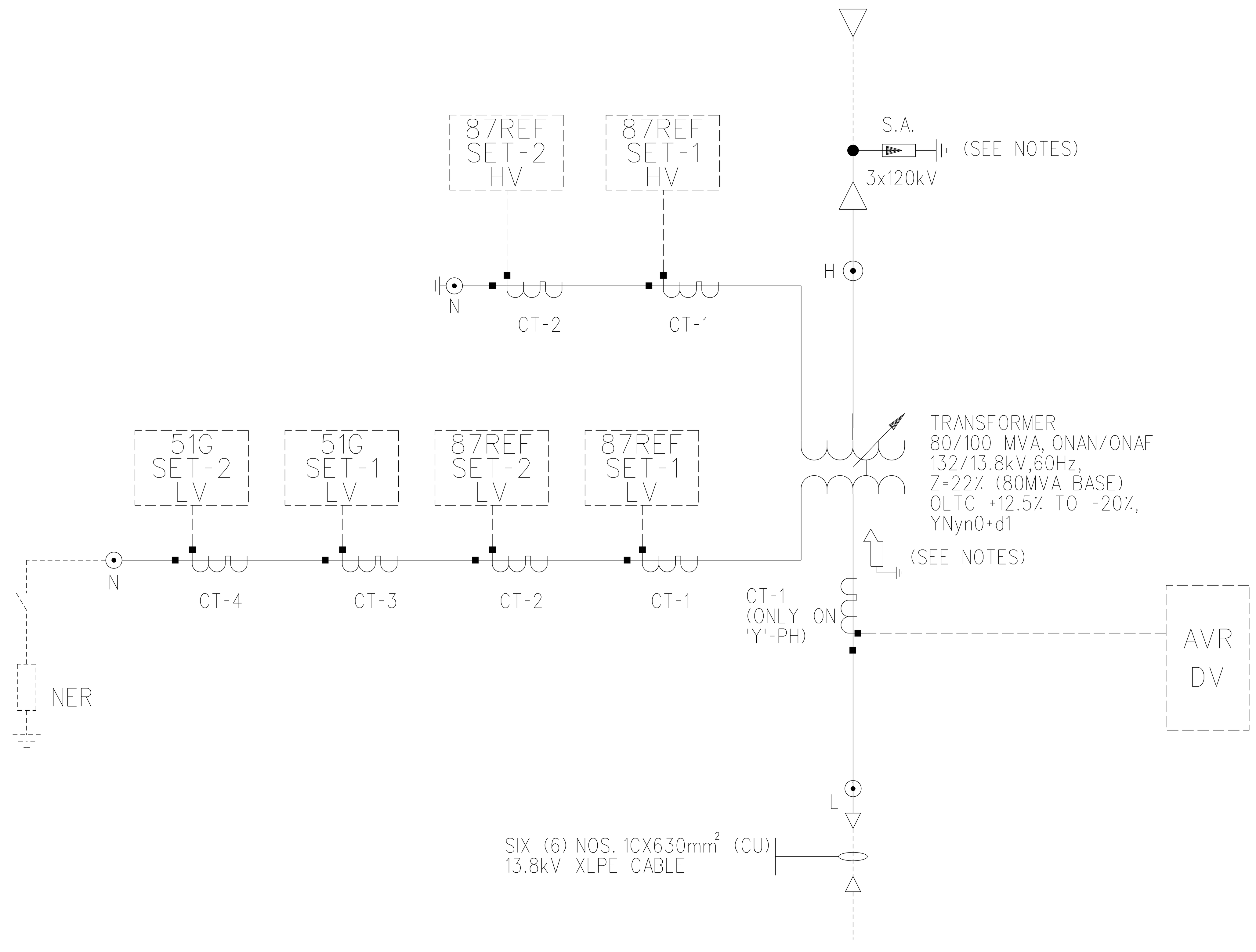
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LEGEND

DEVICE FUNCTION NUMBERS ;

51G	GROUND OVERCURRENT- INVERSE TIME
PQM	POWER QUALITY METER
87REF	RESTRICTED EARTH FAULT RELAY
SA	SURGE ARRESTER
AVR	AUTOMATIC VOLTAGE REGULATOR
DV	DIGITAL VOLT METER



TR100-YNyn0+d1-132

PROTECTION CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	Vk [V]	Rct [Ohm]	Im [mA]	BURDEN [VA]	APPLICATION
HV SIDE							
CT-1	300/1	PX	> 360	< 1	< 50*	-	REF-SET-1
	600/1		> 720	< 2	< 25*	-	
CT-2	300/1	PX	> 360	< 1	< 50*	-	REF-SET-2
	600/1		> 720	< 2	< 25*	-	
*AT CORRESPONDING Vk							

PROTECTION CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	Vk [V]	Rct [Ohm]	Im [mA]	BURDEN [VA]	APPLICATION
LV SIDE							
CT-1	3600/1	PX	> 800	< 16	< 25*	-	REF-SET-1
CT-2	3600/1	PX	> 800	< 16	< 25*	-	REF-SET-2
CT-3	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-1
CT-4	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-2
*AT CORRESPONDING Vk **AT LOWEST RATIO							

METERING CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	BURDEN [VA]
HV BUSHING			
LV BUSHING (Only 'y' Phase)			
CT-1	1750/1	0.5	30
LV BUSHING			

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	CT-926693
SCOPE OF WORK AND TECHNICAL SPECIFICATIONS	PTS-24CM1046

AS-BUILT BY ______ DATE ______

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.

DRAWING COMPLETION CERTIFICATE (DCC):

الشركة الوطنية لنقل الكهرباء

نقل الكهرباء National Grid SA

DRAWN BY AHO CHECKED BY AMS/KIH SCALE: NONE

DATE STARTED 2024-07-02 DATE COMPLETED 2024-07-02

OPR'G. DEPT. ______ ENG. DEPT. ______

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED BY ______ DATE ______

ONE LINE DIAGRAM

TR100-YNyn0+d1-132

PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS

SAUDI ARABIA

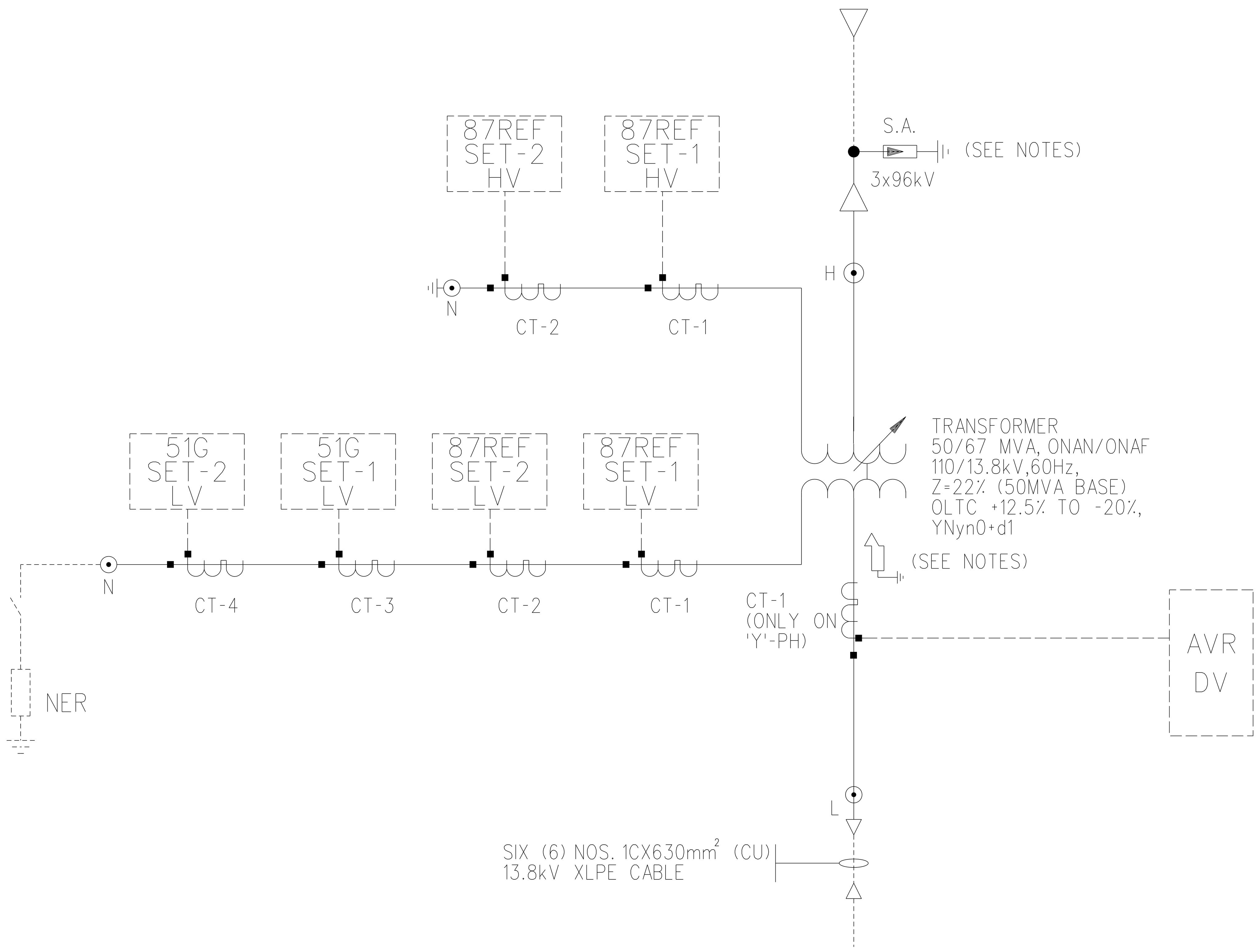
CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926695	01 of 01	00

NG-A (2012/01)

VECTOR NGA00

NOTES

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TR67-YNyn0+d1-110

PROTECTION CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	Vk [V]	Rct [Ohm]	Im [mA]	BURDEN [VA]	APPLICATION
HV SIDE							
CT-1	300/1	PX	>360	<1	<50*	-	REF-SET-1
	600/1		>720	<2	<25*	-	
CT-2	300/1	PX	>360	<1	<50*	-	REF-SET-2
	600/1		>720	<2	<25*	-	

*AT CORRESPONDING Vk

PROTECTION CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	Vk [V]	Rct [Ohm]	Im [mA]	BURDEN [VA]	APPLICATION
LV SIDE							
CT-1	3600/1	PX	>800	<16	<25*	-	REF-SET-1
CT-2	3600/1	PX	>800	<16	<25*	-	REF-SET-2
CT-3	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-1
CT-4	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-2

*AT CORRESPONDING Vk
**AT LOWEST RATIO

METERING CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	BURDEN [VA]
HV BUSHING			
LV BUSHING (Only 'y' Phase)			
CT-1	2803/1	0.5	30
LV BUSHING			

LEGEND

DEVICE FUNCTION NUMBERS :

51G	GROUND OVERCURRENT- INVERSE TIME
PQM	POWER QUALITY METER
87REF	RESTRICTED EARTH FAULT RELAY
SA	SURGE ARRESTER
AVR	AUTOMATIC VOLTAGE REGULATOR
DV	DIGITAL VOLT METER

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	CT-926693
SCOPE OF WORK AND TECHNICAL SPECIFICATIONS	PTS-24CM1046

AS-BUILT BY ______ DATE ______

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.

DRAWING COMPLETION CERTIFICATE (DCC):

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National Grid SA

DRAWN BY AHO CHECKED BY AMS/KIH SCALE: NONE
DATE STARTED 2024-07-02 DATE COMPLETED 2024-07-02
OPR'G. DEPT. ______ ENG. DEPT. ______

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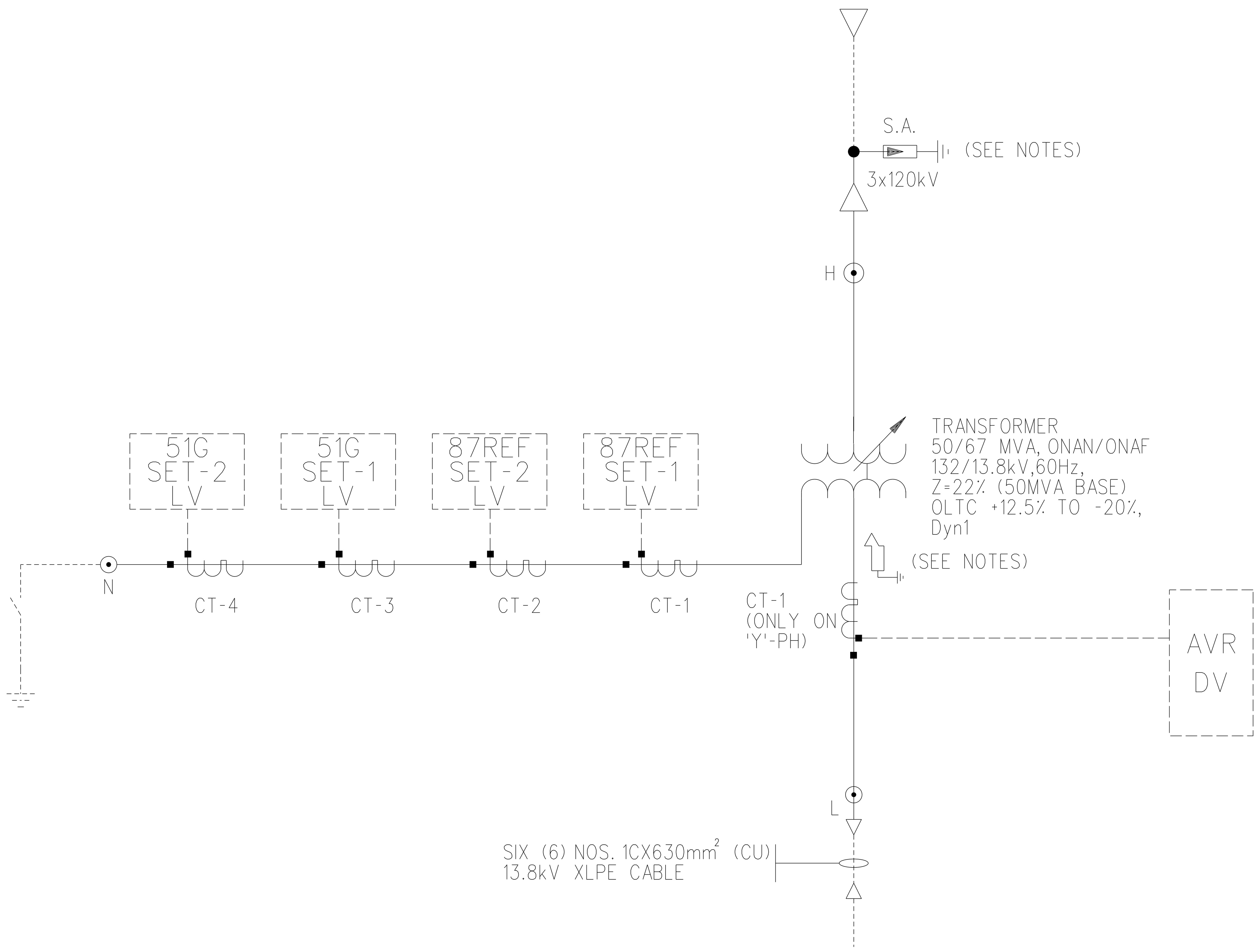
CERTIFIED BY ______ DATE ______

ONE LINE DIAGRAM
TR67-YNyn0+d1-110
PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS
SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926696	01 of 01	00

NG-A (2012/01)
VECTOR
NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926696	01 of 01	00



TR67-DYN1-132

PROTECTION CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	Vk [V]	Rct [Ohm]	Im [mA]	BURDEN [VA]	APPLICATION
LV SIDE							
CT-1	3600/1	PX	>800	<16	<25*	-	REF-SET-1
CT-2	3600/1	PX	>800	<16	<25*	-	REF-SET-2
CT-3	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-1
CT-4	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-2

*AT CORRESPONDING Vk
**AT LOWEST RATIO

METERING CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	BURDEN [VA]
HV BUSHING			
LV BUSHING (Only 'y' Phase)			
CT-1	2803/1	0.5	30
LV BUSHING			

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LEGEND

DEVICE FUNCTION NUMBERS :

51G	GROUND OVERCURRENT- INVERSE TIME
PQM	POWER QUALITY METER
87REF	RESTRICTED EARTH FAULT RELAY
SA	SURGE ARRESTER
AVR	AUTOMATIC VOLTAGE REGULATOR
DV	DIGITAL VOLT METER

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	CT-926693
SCOPE OF WORK AND TECHNICAL SPECIFICATIONS	PTS-24CM1046

AS-BUILT BY ______ DATE ______

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.

DRAWING COMPLETION CERTIFICATE (DCC):

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نقل الكهرباء
National Grid SA

DRAWN BY AHO CHECKED BY AMS/KIH SCALE: NONE

DATE STARTED 2024-07-02 DATE COMPLETED 2024-07-02

OPR'G. DEPT. ______ ENG. DEPT. ______

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CERTIFIED BY ______ DATE ______

ONE LINE DIAGRAM
TR67-DYN1-132
PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS
SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926697	01 of 01	00

NG-A (2012/01)
VECTOR
NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926697	01 of 01	00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926698	01 of 01	00

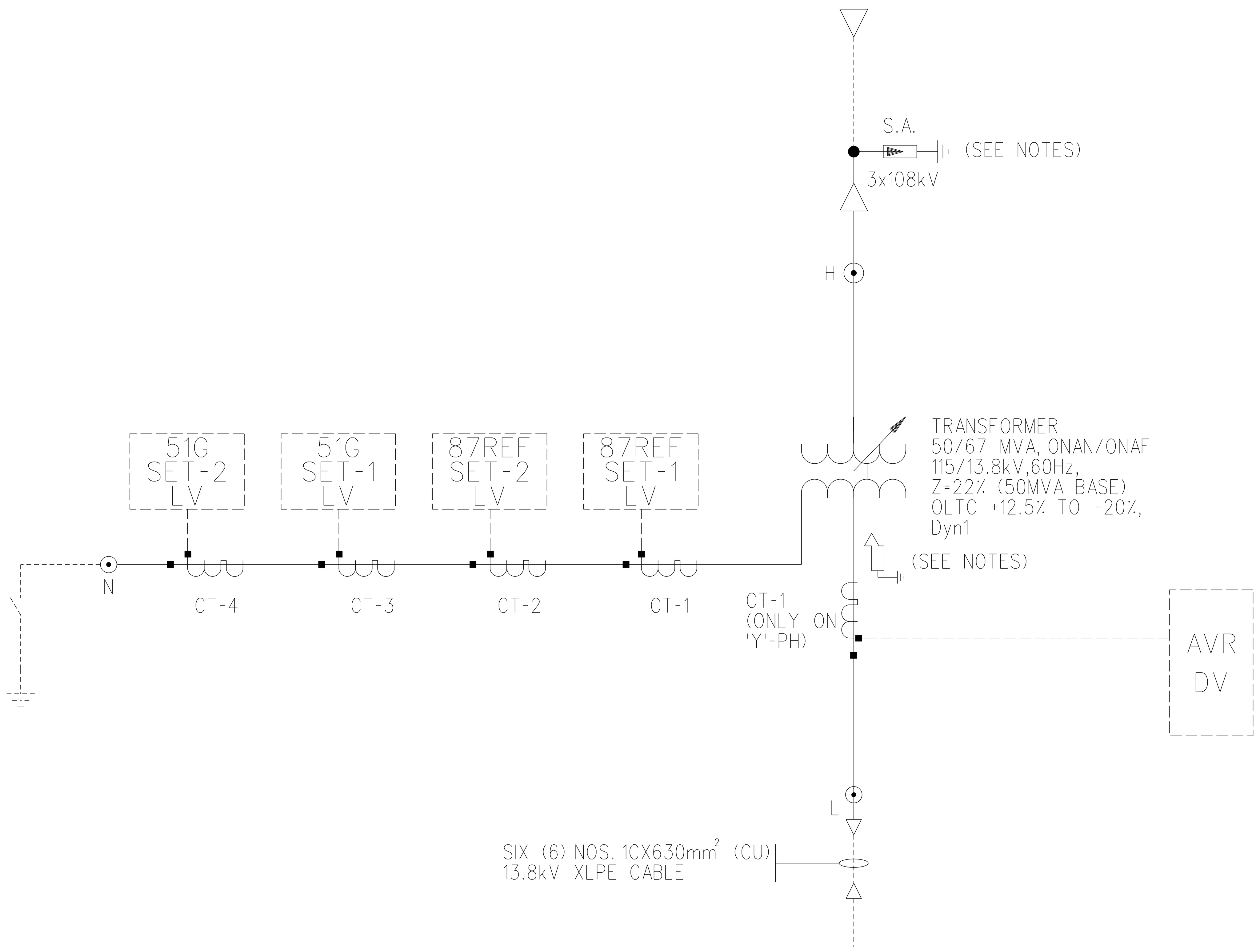
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LEGEND

DEVICE FUNCTION NUMBERS ;

51G	GROUND OVERCURRENT- INVERSE TIME
PQM	POWER QUALITY METER
87REF	RESTRICTED EARTH FAULT RELAY
SA	SURGE ARRESTER
AVR	AUTOMATIC VOLTAGE REGULATOR
DV	DIGITAL VOLT METER



TR67-DYN1-115

PROTECTION CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	Vk [V]	Rct [Ohm]	Im [mA]	BURDEN [VA]	APPLICATION
LV SIDE							
CT-1	3600/1	PX	>800	<16	<25*	-	REF-SET-1
CT-2	3600/1	PX	>800	<16	<25*	-	REF-SET-2
CT-3	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-1
CT-4	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-2

*AT CORRESPONDING Vk
**AT LOWEST RATIO

METERING CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	BURDEN [VA]
HV BUSHING			
LV BUSHING (Only 'y' Phase)			
CT-1	2803/1	0.5	30
LV BUSHING			

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	CT-926693
SCOPE OF WORK AND TECHNICAL SPECIFICATIONS	PTS-24CM1046

AS-BUILT BY ____ DATE ____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.

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نقل الكهرباء National Grid SA

DRAWN BY AHO CHECKED BY AMS/KIH SCALE: NONE

DATE STARTED 2024-07-02 DATE COMPLETED 2024-07-02

OPR'G. DEPT. ____ ENG. DEPT. ____

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CERTIFIED BY ____ DATE ____

ONE LINE DIAGRAM

TR67-DYN1-115

PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS

SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926698	01 of 01	00

NG-A (2012/01)

VECTOR

NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926699	01 of 01	00

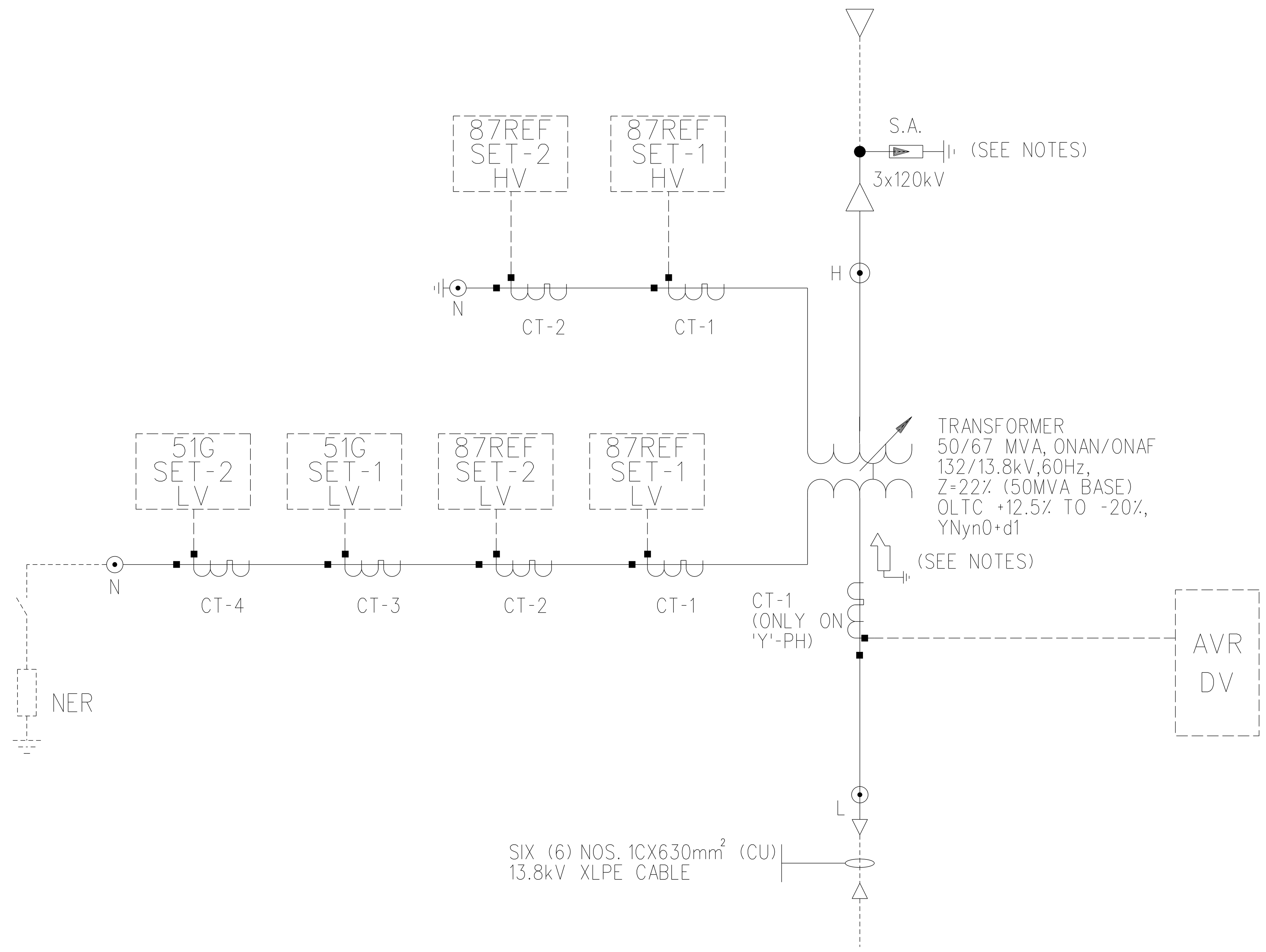
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LEGEND

DEVICE FUNCTION NUMBERS :

51G	GROUND OVERCURRENT- INVERSE TIME
PQM	POWER QUALITY METER
87REF	RESTRICTED EARTH FAULT RELAY
SA	SURGE ARRESTER
AVR	AUTOMATIC VOLTAGE REGULATOR
DV	DIGITAL VOLT METER



TR67-YNyn0+d1-132

PROTECTION CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	Vk [V]	Rct [Ohm]	Im [mA]	BURDEN [VA]	APPLICATION
HV SIDE							
CT-1	300/1	PX	> 360	< 1	< 50*	-	REF-SET-1
	600/1		> 720	< 2	< 25*	-	
CT-2	300/1	PX	> 360	< 1	< 50*	-	REF-SET-2
	600/1		> 720	< 2	< 25*	-	
*AT CORRESPONDING Vk							

PROTECTION CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	Vk [V]	Rct [Ohm]	Im [mA]	BURDEN [VA]	APPLICATION
LV SIDE							
CT-1	3600/1	PX	> 800	< 16	< 25*	-	REF-SET-1
CT-2	3600/1	PX	> 800	< 16	< 25*	-	REF-SET-2
CT-3	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-1
CT-4	(1500-800)/1	5P20	-	-	-	30**	E/F-SET-2
*AT CORRESPONDING Vk **AT LOWEST RATIO							

METERING CT SPECIFICATION

CT NO.	RATIO [A/A]	CLASS	BURDEN [VA]
HV BUSHING			
LV BUSHING (Only 'y' Phase)			
CT-1	2803/1	0.5	30
LV BUSHING			

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	CT-926693
SCOPE OF WORK AND TECHNICAL SPECIFICATIONS	PTS-24CM1046

AS-BUILT BY ______ DATE ______

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.

DRAWING COMPLETION CERTIFICATE (DCC):

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نقل الكهرباء National Grid SA

DRAWN BY AHO CHECKED BY AMS/KIH SCALE: NONE
DATE STARTED 2024-07-02 DATE COMPLETED 2024-07-02
OPR'G. DEPT. ______ ENG. DEPT. ______

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CERTIFIED BY ______ DATE ______

ONE LINE DIAGRAM
TR67-YNyn0+d1-132
PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS
SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
		P	NG2150	CT-926699	01 of 01	00

NG-A (2012/01)
VECTOR
NGA00

APPENDIX-2

MATERIAL DATA SCHEDULES

6.0 DATA SCHEDULE

TERMINAL BLOCKS

SEC Enquiry No. ______________________ Date: __________

SEC Purchase Order No. or Contract No. ______________________ Date: __________

SEC PTS No./Project Title with J.O. No. **Refer To Main SOW/TS**

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.0	DESIGN AND CONSTRUCTION REQUIREMENTS			
4.1	Terminal Block Make	*		
	Type/Model No.	*		
	Catalogue Enclosed	Yes		
	Comparative Tracking Index (CTI)	≥600		
	Creepage distance (mm)	*		
	Material group per IEC 60947-1	I		
	Insulation material	Polyamide 6		
	Pollution Degree	3 or above		

A'- SEC SPECIFIED DATA/PARAMETER.
'B'- BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS.
'C'- REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'.
(*)- DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/SUPPLIER/ VENDOR/CONTRACTOR IN COLUMN 'B'.

6.0 DATA SCHEDULE

TERMINAL BLOCKS

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3	Rated insulation voltage	*		
	Impulse withstand voltage	*		
	Rated current	*		
	Rated short time withstand current	*		
	Cross sectional area	*		
	Jumper bars size/rating	*		
	Sliding link rating	*		
	End section/stop size/rating	*		
4.5	Terminal Block Type	Screw/Spring loaded/Plug-in		
	CT Terminal Block –Disconnecting CT shorting terminal with ground link	*		
	VT Circuits Terminal Block	Sliding Link		
	Other types of Terminal Block	*		
	Tightening torque	*		
	Degree of protection	IP2x		
	Test sockets size/rating	*		
	Shot circuit plugs size/rating	*		
	Number of connections	1/2		
	Number of levels	1		
	Mounting on DIN rail acc. to IEC 60715	*		

6.0 DATA SCHEDULE

TERMINAL BLOCKS

A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES TO BE FURNISHED BY SEC:

B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/VENDOR/SUPPLIER/CONTRACTOR:

B. OTHER PARTICULARS TO BE FILLED UP BY BIDDER/VENDOR/SUPPLIER/ CONTRACTOR:

	Actual Manufacturer of Equipment/Material	Vendor/Supplier/ Contractor
Name of the Company	________________	________________
Location and address	________________	________________
	________________	________________
Name and Signature of authorized representative and date	________________	________________
	________________	________________
	________________	________________
Official Seal/Stamp of the Company & Date	________________	________________

6.0 DATA SCHEDULE

SURGE ARRESTER FROM 11kV THROUGH 380kV NOMINAL

National Grid SA Enquiry No. ______________________ Date: __________

National Grid SA Purchase Order No. or Contract No ______________________ Date: __________

National Grid SA PTS No./Project Title with J.O. No. ______________________

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
	SYSTEM DATA			
	Nominal System Voltage(kV) (11kV, 13.8kV, 33kV, 34.5kV, 69kV, 110kV, 115kV, 132kV, 230kV or 380kV)	*		
	System Fault Current Level at Rated System Voltage (kA)	*		
	Maximum Duration of Ground Fault (ms)	*		
	System Neutral Grounding at Arrester Point Of Installation (Effectively, Non-Effectively Grounded)			

'A'- NATIONAL GRID SA SPECIFIED DATA/PARAMETER.
'B'- BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS.
'C'- REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'.
(*)- DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/SUPPLIER/ VENDOR/CONTRACTOR IN COLUMN 'B'.

6.0 DATA SCHEDULE

SURGE ARRESTER FROM 11kV THROUGH 380kV NOMINAL

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
	System Component(s) to be protected			
	Transmission Line			
	Surge Impedance (ohms)	*	______	______
	Length (kM)	*	______	______
	Underground Cable			
	Capacitance (µF/kM)	*	______	______
	Length (kM)	*	______	______
	Capacitor Banks			
	Capacitance (MVAR)	______	______	______
	Others (Power Transformers, Reactors, GIS etc., attach details)	*	______	______
3.0	APPLICABLE INDUSTRY STANDARDS	*	______	______
4.0	DESIGN AND CONSTRUCTION REQUIREMENTS			
4.1	General			
	Type	*	______	______
	Model Designation	*	______	______
	Location (Indoor/Outdoor)	______	______	______
4.2	Performance Characteristics and Ratings			
	Rated Voltage (*U*r)	______	______	______
	Continuous operating voltage (*U*c)	______	______	______
	Arrester Class/(LDC)	*	______	______
	Dielectric Withstand for Housing			
	Lightning impulse withstand voltage, with 1.2/50µs waveform (kV_{peak})	*	______	______
	Power frequency withstand voltage (Wet for Outdoor/Dry for indoor)	*	______	______
	Switching impulse withstand voltage With 250/2500µs waveform (for arrester with rated voltage 200kV and above (kV_{peak})	*	______	______

6.0 DATA SCHEDULE

SURGE ARRESTER FROM 11kV THROUGH 380kV NOMINAL

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.2	Contd.			
	Nominal Discharge Current (Lightning Impulse Classifying Current) with 8/20 µs waveform (kA)	*	______	______
	High Current impulse Capability with 4/10µs Waveform (kA_{peak})	*	______	______
	Maximum Lightning Impulse Residual Voltage With 8/20 µs waveform (kV_{peak}) at a Discharge Classifying) current of:			
	- 5kA	*	______	______
	- 10kA	*	______	______
	- 20kA	*	______	______
	- 40kA	*	______	______
	Maximum Switching Surge Residual Voltage (kV_{peak}) at Discharge Current of			
	- 0.5kA	*	______	______
	- 1kA	*	______	______
	- 2kA	*	______	______
	Maximum Steep Current /Front-of-Wave Residual Voltage Based on 1/ 2 or 0.5 µs Waveform as Applicable (kV_{peak})			
	- 10kA	*	______	______
	- 20kA	*	______	______
	Temporary over voltage capability (kV_{rms}) (Manufacturer shall submit curve for TOV for the Following duration with and without Prior duty)			
	- 0.1second	*	______	______
	- 1 second	*	______	______
	- 10 second	*	______	______
	100second	*	______	______
	Maximum R.I.V (µv)	*	______	______

6.0 DATA SCHEDULE

SURGE ARRESTER FROM 11kV THROUGH 380kV NOMINAL

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.2	Contd.			
	Maximum External Insulation Levels			
	Power Frequency Dry Withstand Voltage (kVrms)	*		
	Power frequency wet withstand voltage (kVrms)	*		
	Lightning impulse withstand voltage (kVpeak)	*		
	Switching impulse withstand voltage (kVpeak)	*		
	Leakage current through Arrester at COV (Uc) (mA)	*		
	Maximum Energy Absorption Capability per Thermal Energy Rating (Wth) kJ/kV of arrester rated Volatge (*U*r)			
	Repetitive Charge Transfer rating (Q_{rs}(C))			
	Maximum resistive current acceptable	*		
4.3	Construction			
	Pressure Relief Capability (rms symmetrical)			
	High Current Short duration			
	Low current, long duration (A)	600		
	Arrester Housing	Porcelain/Polymer		
	Color	*		
	Creepage Distance (mm)	*		
	Bending Failing Load (kN)	*		
	Cantilever Strength min (kN)	*		
	Torsional Strength (kN)	*		
	Compression Strength (kNm)	*		
	No. of Stacks in each unit	*		
	Height (mm)	*		

6.0 DATA SCHEDULE

SURGE ARRESTER FROM 11kV THROUGH 380kV NOMINAL

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3	Contd.			
	Internal Pressure Required to Operate Pressure relief device as a Percent of Pressure required to Burst Porcelain (%)	*		
	Mounting arrangement			
	Mode of mounting (self-supporting/bracket			
	Bracket supporting)	*		
	Bolt circle diameter (mm)	*		
	No. of holes	*		
	Size of Bolts (mm)	*		
	Accessories			
	Scale range of leakage ammeter (mA)	*		
	Diameter of the grading ring if applicable (mm)	*		
	Material of grading ring if applicable	*		
	Terminals			
	Type	Pad		
	Size (mm)	*		
	Material (Al or CU)	*		
	Grounding			
	Size (mm)	*		
	Material	*		
	MISCELLANEOUS			
	Minimum clearance between live parts and earth parts (mm)	*		
	Minimum Permissible Center to Center Distance between Arresters (mm)	*		
	Overall Height of arrester (mm)	*		
	Weight of arrester (kg)	*		

6.0 DATA SCHEDULE

SURGE ARRESTER FROM 11kV THROUGH 380kV NOMINAL

A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES TO BE FURNISHED BY NATIONAL GRID,SA:

B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/VENDOR/SUPPLIER/CONTRACTOR:

C. OTHER PARTICULARS TO BE FILLED UP BY BIDDER/VENDOR/SUPPLIER/ CONTRACTOR:

	Actual Manufacturer of Equipment/Material	Vendor/Supplier/ Contractor
Name of the Company Location and address	____________ ____________ ____________	____________ ____________ ____________
Name and Signature of authorized representative and date	____________ ____________ ____________	____________ ____________ ____________
Official Seal/Stamp of the Company & Date	____________	____________

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

National Grid Saudi Arabia Enquiry No. ______________________ Date: ____________

National Grid, Saudi Arabia, Purchase Order No. or Contract No. ______________________ Date: ____________
.

National Grid, Saudi Arabia PTS No./Project Title with J.O. No. ______________________

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
	Power Transformer Model No./Type No.	*	______	______
	Type of System Grounding(Solidly grounded, resistance grounded, other)			
	HV	______	______	______
	LV	______	______	______
	TV (if applicable)	______	______	______
	Common Neutral (Auto Transformer)	______	______	______
3.0	Applicable Industry Standards	*	______	______
4.0	DESIGN AND CONSTRUCTION REQUIREMENTS			
4.1	Design Ambient Temperature (°C)	*	______	______
	Number of Windings	______	______	______
	Type of Cooling	______	______	______
	Vector Group Designation	______	______	______

A'- SEC SPECIFIED DATA/PARAMETER.
'B'- BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS.
'C'- REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'.
(*)- DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/SUPPLIER/ VENDOR/CONTRACTOR IN COLUMN 'B'.

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.1	Natural Cooling Rating HV/LV/TV (MVA)	/ /	/ /	/ /
	1st Stage Forced Cooling HV/LV/TV (MVA)	/ /	/ /	/ /
	2nd Stage Forced Cooling HV/LV/TV (MVA)	/ /	/ /	/ /
	Rated Voltage Transformation Ratio HV/LV/TV (kV)	/ /	/ /	/ /
	Temperature Rise Based on Ambient Temperature Conditions Specified in 01-TMSS-01			
	Winding °C	*		
	Oil °C	*		
	Winding maximum (hot spot) Temperature (°C)	*		
	Design X/R ratio			
	HV	*		
	LV	*		
	TV	*		
	Impedance Voltage natural cooling power base and reference temp. of 75°C (%) (Manufacturer shall indicate the value with applicable tolerance)			
	1. At Principal Tap (Guaranteed values)			
	HV - LV			
	HV-TV (if applicable)	*		
	LV-TV (if applicable)	*		
	2. At Extreme Plus Tap			
	HV - LV	*		
	HV-TV (if applicable)	*		
	LV-TV (if applicable)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.1	(continued)			
	3. At Extreme Minus Tap			
	HV - LV	*		
	HV-TV (if applicable)	*		
	LV-TV (if applicable)	*		
	Zero-sequence impedance on natural cooling power base and reference temp. of 75°C (%)(Manufacturer shall indicate the value with applicable tolerance)			
	1. At Principal Tap			
	HV - LV	*		
	HV-TV (if applicable)	*		
	LV-TV (if applicable)	*		
	2. At Extreme Plus Tap			
	HV - LV	*		
	HV-TV (if applicable)	*		
	LV-TV (if applicable)	*		
	3. At Extreme Minus Tap			
	HV - LV	*		
	HV-TV (if applicable)	*		
	LV-TV (if applicable)	*		
	Highest Design Operating Voltage for the tappings			
	continuous operation (%)	105		
	emergency operation (%)	110		
	Maximum Design Flux Density			
	at rated voltage (Tesla)	*		
	at 110% rated voltage (Tesla)	*		
	Saturation Voltage (%U_N)	*		
	Current density at rated output			
	Primary winding (Amp/mm^2)	*		
	Secondary winding (Amp/mm^2)	*		
	Tertiary winding (Amp/mm^2)	*		
	No-load current when excited from LV side as % of full load current	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.1 (continued)				
	100% voltage (Guaranteed value)	*		
	105% voltage	*		
	110% voltage	*		
	No-load current harmonics at 100% and 110% rated voltage (%)			
	2nd Harmonics	*/*	/	/
	3rd Harmonics	*/*	/	/
	4th Harmonics	*/*	/	/
	5th Harmonics	*/*	/	/
	6th Harmonics	*/*	/	/
	7th Harmonics	*/*	/	/
	8th Harmonics	*/*	/	/
	9th Harmonics	*/*	/	/
	Basic Impulse Withstand Voltage (BIL)			
	HV winding (kV_{peak})	*		
	LV winding (kV_{peak})	*		
	HV neutral end (kV_{peak})	*		
	LV neutral end (kV_{peak})	*		
	Common neutral for auto transformer winding (kV_{peak})	*		
	Tertiary winding (kV_{peak})	*		
	Tertiary neutral end (kV_{peak}) (if applicable)	*		
	Switching Impulse Withstand Voltage (BSL) if applicable (kV_{peak})	*		
	Separate Source Power Frequency Withstand Voltage			
	HV winding (kV_{rms})	*		
	LV winding (kV_{rms})	*		
	HV neutral end (kV_{rms})	*		
	LV neutral end (kV_{rms})	*		
	Common neutral for auto transformer winding (kV_{rms})	*		
	Tertiary Winding (kV_{rms})	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.1 (continued)				
	Tertiary neutral end (kV_{rms}) (if applicable)	*		
4.3.3	Requirement for parallel operation	Yes/No		
4.3.4	Guaranteed No-Load Losses at rated frequency (kW)			
	- at 100% rated voltage	*		
	No-Load Losses at rated frequency			
	- at 105% rated voltage	*		
	- at 110% rated voltage	*		
	Guaranteed Load Losses at 75°C at principal tappings (kW) for Natural Cooling Rating (ONAN)			
	- HV to LV	*		
	Guaranteed Load Losses at 75°C at principal tappings (kW) for Natural Cooling Rating (ONAN)			
	- LV to TV at TV rated power	*		
	- HV to TV at TV rated power	*		
	Guaranteed Load Losses at 75°C at principal tappings (kW) for Stage 1 Cooling Rating			
	- HV to LV	*		
	- LV to TV at TV rated power	*		
	- HV to TV at TV rated power	*		
	Guaranteed Load Losses at 75°C at principal tappings (kW) for Stage 2 Cooling Rating			
	- HV to LV	*		
	- LV to TV at TV rated power	*		
	- HV to TV at TV rated power	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.4 (continued)				
	Load Losses at 75°C at tappings having highest losses (kW)			
	- Tap Position No.	*		
	- HV to LV	*		
	- HV to TV	*		
	Total losses of auxiliaries, pumps and fans in service at full load (kW)			
	at Stage 1 cooling	*		
	at Stage 2 cooling	*		
4.3.6	Maximum Symmetrical short circuit current for which windings are designed to thermally withstand			
	Duration (seconds)	*		
	HV winding (kA)	*		
	LV winding (kA)	*		
	TV winding (kA)	*		
	Maximum Asymmetrical short circuit current for which the windings are mechanically designed			
	HV winding (kA_{peak})	*		
	LV winding (kA_{peak})	*		
	TV winding (kA_{peak})	*		
	Thermal and mechanical damage curve per IEEE C57.109 enclosed	*	Yes/No	
4.3.7	Temperature rise test to prove tertiary winding rating required	Yes/No		
	Transferred overvoltage calculation for tertiary winding enclosed	*	Yes/No	

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.9	Noise level at rated voltage and frequency			
	- at Natural Cooling (dB)			
	- at Stage 1 Cooling (dB)	*		
	- at Stage 2 Cooling (dB)	*		
4.4	Construction			
4.4.1	Type of tank construction			
	Tank Cover	Welded		
	Min. thickness of tank steel (mm)			
	- Sides	*		
	- Base	*		
	- Cover	*		
	Min. Thickness of radiator plates (mm)	*		
	Maximum Positive Withstand Pressure of Tank and Radiators (kPa)	*		
	Minimum Vacuum Withstand (milli bar)	*		
4.4.3	Winding Insulation			
	HV Winding	*	Uniform/ Graded	
	LV Winding	*	Uniform/ Graded	
	TV Winding	Uniform		
	Winding Leakage Reactance (ohm)	*		
4.5	Tap Changer	On load		
	Manufacturer	*		
	Type	Oil/Vacuum		
	Type Designation	*		
	Tap Arrangment (Linear, Reversing or Coarse/fine)	*		
	Number of steps			
	Step Voltage (%)			
	Tapping Range (%)			
	Rated Through Current (A)	*		
	Short Circuit Current (kA)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.5 (continued)				
	Dynamic short circuit current (kA_{peak})	*		
	Location (In-tank type fitted inside transformer main tank/outside transformer main tank or External mounted type)	*		
	Voltage Class (kV_{rms})	*		
	BIL (kV_{peak})	*		
	Type of transition impedance (high resistance)	*		
	Time of transfer from one step to another			
	- motor-operated (seconds)	*		
	- manually operated (Number of revolution)	*		
	Oil filter unit for Oil type OLTC	*		
	Motor drive unit:			
	Type	*		
	Power	*		
	Rated Voltage (V_{ac})/(V_{dc})			
	Number of phases			
	Control voltage (V_{ac} or V_{dc})			
	Space heater (V_{ac})	230		
	Heater Wattage (W)	*		
	Provision of parallel operation along with Supervisory Equipment	Yes/No		
	Oil/Gas Surge Relay for OLTC			
	Manufacturer	*		
	Type Designation	*		
	Alarm Contact Current Rating at 125 V_{dc} (A)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.5 (continued)				
	Pressure Relief Device (OLTC)			
	Manufacturer	*		
	Type Designation	*		
	Number of Pressure Relief Device(s)	*		
	Resealing Pressure (kPa)	*		
	Number of alarm/trip contacts	2		
	Alarm Contact Current Rating at 125 V_{dc} (A)	*		
4.6.1	Oil Temperature Indicator			
	Manufacturer	*		
	Type Designation	*		
	Type of Liquid Sensing Element	*		
	Provision of maximum indicator	Yes/No		
	Adjustment Range of Alarm and Trip contacts (From_to_°C)	0-160ºC		
	Adjustment Range of Forced cooling contacts (From_to_°C)	0-160ºC		
	Contact Current Rating at 125 V_{dc} (A)	*		
	Number of contacts	4		
4.6.2	Winding Temperature Indicator			
	Manufacturer	*		
	Type Designation	*		
	Type of Liquid Sensing Element	*		
	Provision of maximum indicator	Yes/No		
	Adjustment Range of Alarm and Trip contacts (From_to_°C)	0-160ºC		
	Adjustment Range of Forced cooling contacts (From_to_°C)	0-160ºC		
	Contact Current Rating at 125 V_{dc} (A)	*		
	Number of contacts	4		
4.6.3.c	No. of sensors			
	HV Winding			
	LV Winding			

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.8	Buchholz Relay			
	Manufacturer	*		
	Type Designation	*		
	Alarm/Trip Contact Current Rating at 125 V_{dc} (A)	*		
4.9	Pressure Relief Device (Main Tank)			
	Manufacturer	*		
	Type Designation	*		
	Pressure Range for Operation	*		
	Resealing Pressure (kPa)	*		
	Number of alarm/trip contacts	2		
	Alarm Contact Current Rating at 125 V_{dc} (A)	*		
	Rapid Pressure Rise Relay	Yes/No		
4.10	Bushings			
	High Voltage Bushings			
	Manufacturer & Country	*		
	Type designation	*		
	Material	*		
	Location (top, side, others)			
	Terminal take off angle (vertical, horizontal, angle)			
	Number			
	Rated Voltage (kV)			
	Rated Maximum Voltage (kV)			
	Rated current (A)	*		
	BIL (kV_{peak})	*		
	Switching Impulse Withstand Voltage, if applicable (kV_{peak})	*		
	Power Frequency Dry/Wet Withstand Voltage (kV_{rms})	*		
	Creepage distance (mm)	*		
	Cantilever strength (kN)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.10 (continued)				
	Mounting details			
	Hole circle diameter of the flange (mm)	*		
	Number of bolts	*		
	Hole diameter (mm)	*		
	Terminal			
	Type	*		
	Size	*		
	No. of holes, if applicable	*		
	Low Voltage Bushing			
	Manufacturer & Country	*		
	Type designation	*		
	Material	*		
	Location (top, side, others)			
	Terminal take off angle (vertical, horizontal, angle)			
	Number			
	Rated Voltage (kV)			
	Rated Maximum Voltage (kV)			
	Rated current (A)	*		
	BIL (kV_{peak})	*		
	Power Frequency Dry/Wet Withstand Voltage (kV_{rms})	*		
	Creepage distance (mm)	*		
	Cantilever strength (kN)	*		
	Mounting Details			
	Hole circle diameter of the flange (mm)	*		
	Number of bolts	*		
	Hole circle diameter (mm)	*		
	Terminal			
	Type	*		
	Size	*		
	No. of holes, if applicable	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.10 (continued)	HV Neutral Bushing			
	Manufacturer & Country	*		
	Type designation	*		
	Material	*		
	Location (top, side, others)			
	Terminal take off angle (vertical, horizontal, angle)			
	Rated Voltage (kV)	*		
	Rated Maximum Voltage (kV)	*		
	Rated current (A)	*		
	BIL (kV_{peak})	*		
	Power Frequency Dry/Wet Withstand Voltage (kV_{rms})	*		
	Creepage distance (mm)	*		
	Cantilever strength (kN)	*		
	Mounting details			
	Hole circle diameter of the flange (mm)	*		
	Number of bolts	*		
	Hole circle diameter (mm)	*		
	Terminal			
	Type	*		
	Size	*		
	No. of holes, if applicable	*		
	LV Neutral Bushing/Common Neutral Bushing for Auto Transformer			
	Manufacturer	*		
	Type designation	*		
	Material	*		
	Location (top, side, others)			
	Terminal take off angle (vertical, horizontal, angle)			
	Rated Voltage (kV)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.10 (continued)				
	Rated Maximum Voltage (kV)	*		
	Rated current (A)	*		
	BIL (kV_{peak})	*		
	Power Frequency Dry/Wet Withstand Voltage (kV_{rms})	*		
	Creepage distance (mm)	*		
	Cantilever strength (kN)	*		
	Mounting details			
	Hole circle diameter of the flange (mm)	*		
	Number of bolts	*		
	Hole circle diameter (mm)	*		
	Terminal			
	Type	*		
	Size	*		
	No. of holes, if applicable	*		
	Tertiary Bushing			
	Manufacturer & Country	*		
	Type designation	*		
	Material	*		
	Location (top, side, others)			
	Terminal take off angle (vertical, horizontal, angle)			
	Rated Voltage (kV)			
	Rated Maximum Voltage (kV)	*		
	Rated current (A)	*		
	BIL (kV_{peak})	*		
	Power Frequency Dry/Wet Withstand Voltage (kV_{rms})	*		
	Creepage distance (mm)	*		
	Cantilever strength (kN)	*		
	Mounting details			
	Hole circle diameter of the flange (mm)	*		
	Number of bolts	*		
	Hole circle diameter (mm)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.10 (continued)				
	Terminal			
	Type	*		
	Size	*		
	No. of holes, if applicable	*		
4.13 & 4.14	Cooling Equipment			
	Fans	*		
	Manufacturer & Country			
	Number of cooling fans (main/spare)	*		
	Number of cooling fan groups	*		
	Power rating of each fan	*		
	Supply Voltage (V_{ac})	*		
	Number of phases	*		
	Number of wires	*		
	Total fan consumption at full load (kW)	*		
	Degree of protection for fan blades	*		
	Pumps			
	Manufacturer & Country			
	Number of oil pumps	*		
	Type designation	*		
	Motor rating (kW/HP)	*		
	Supply Voltage (V_{ac})	*		
	Number of phases	*		
	Number of wires	*		
	Degree of protection for motor pumps	*		
	Total Power Consumption at full load (kW)	*		
4.15	Conservator			
4.15.2.(	Oil Level Indicator for the Main Tank			
	Manufacturer & Country	*		
	Type Designation	*		
	Alarm Contact Current Rating at 125 V_{dc} (A)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.15.2 (continued)				
	Oil level indicator for OLTC			
	Manufacturer & Country	*		
	Type Designation	*		
	Alarm Contact Current rating at 125 V_{dc} (A)	*		
	Conservator Expansion Device Material	*		
	Manufacturer & Country	*		
4.17	Drain, Filter and Sampling Valves (attach drawing for each type of valve) Manufacturer & Country for each valve			
	Type & Size of Oil Drain Valve (mm)	50		
	Type and Size of Filtration Valve (mm)	50		
	Size of Oil Sampling Valve/s (mm)	20		
	Type & Size of Radiator Valves (mm)	*		
4.19	Transformer Moving Facilities			
	Transformer Base Type	Skid/ Wheels		
	Wheel Details Wheels Center to Center Distance (1100/2100/3100mm)	*		
4.20	Ladder	Yes/No		
4.22	Transformer Terminal Markings	clause 4.20/ IEC 60616		
4.23	Transformer Mineral Oil (Manufacturer shall fill up column “B’ of 54-TMSS-01 Data Schedule)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24	Bushing Current Transformer			
	High Voltage Bushing Current Transformers			
	Manufacturer & Country	*		
	Type Designation	*		
	No. of CTs per phase			
	Continuous Thermal Current Rating Factor			
	Metering CT			
	Protection CT			
	Multi Ratio CTs (MRCT)			
	Single Ratio CTs			
	Rated Short Time Withstand Current			
	Thermal I_{th} (kA)	*		
	Dynamic (kA_{peak})	$2.6xI_{th}$		
	Short Time Thermal Current duration (sec.)			
	Rated primary short circuit current I_{PSC} (kA)	*		
	Temperature Rise (°C)	*		
	Core No.	1 /2 /3	1 /2 /3	
	Purpose (Relaying or Metering)	/ /	/ /	
	Type of Protection (Back-up/differential/Distance/REF etc.)	/ /	/ /	
	Current Ratio at specified tap	/ /	/ /	
	Accuracy Class	/ /	/ /	
	Burden (VA)/Resistive Burden-R_b (ohms)	/ /	/ /	
	Secondary Winding Resistance at 20°C, R_{ct} (ohms)	/ /	/ /	

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24 (continued)				
	For class TPS CTs per IEC			
	Rated symmetrical short circuit current factor -K_{SSC}	*/ * /*	/ /	
	Dimensioning parameter -K	*/ * /*	/ /	
	Excitation limiting secondary voltage -U_{al} (Volts)*	*/ * /*	/ /	
	Accuracy limiting secondary exciting current – I_{al} (mA)	*/ * /*	/ /	
	Secondary excitation current-I_{mag} at half excitation limiting secondary voltage (mA)	*/ * /*	/ /	
	For class C or K CTs per IEEE / Class P CT per IEC			
	Magnetizing current -I_{mag} (mA)	*/ * /*	/ /	
	Knee point voltage -V_k (Volts)/ /Secondary limiting e.m.f	*/ * /*	/ /	
	Low Voltage Bushing Current Transformers			
	Manufacturer	*		
	Type Designation	*		
	No. of CTs per phase			
…..				
	Continuous Thermal Current Rating Factor			
	Metering CT			
	Protection CT			
	Multi Ratio CTs (MRCT)			
	Single Ratio CTs			
	Rated Short Time Withstand Current			
	Thermal I_{th} (kA)	*		
	Dynamic (kA_{peak})	$2.6xI_{th}$		
	Short Time Thermal Current duration (sec.)			
	Rated primary short circuit current I_{PSC} (kA)	*		
	Temperature Rise (°C)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24 (continued)				
	Core No.	1 /2 /3	1 /2 /3	
	Purpose (Relaying or Metering)	/ /	/ /	
	Type of Protection (Back-up/differential/Distance/REF etc.)	/ /	/ /	
	Current Ratio at specified tap	/ /	/ /	
	Accuracy Class	/ /	/ /	
	Burden (VA)/Resistive Burden-R_b (ohms)	/ /	/ /	
	Secondary Winding Resistance at 20°C, R_{ct} (ohms)	/ /	/ /	
	<u>For class TPS CTs per IEC</u>			
	Rated symmetrical short circuit current factor -K_{SSC}	*/ * /*	/ /	
	Dimensioning parameter -K	*/ * /*	/ /	
	Excitation limiting secondary voltage -U_{al} (Volts)*	*/ * /*	/ /	
	Accuracy limiting secondary exciting current – I_{al} (mA)	*/ * /*	/ /	
	Secondary excitation current-I_{mag} at half excitation limiting secondary voltage (mA)	*/ * /*	/ /	
	<u>For class C or K CTs per IEEE / Class P CT per IEC</u>			
	Magnetizing current -I_{mag} (mA)	*/ * /*	/ /	
	Knee point voltage -V_k (Volts)/ /Secondary limiting e.m.f	*/ * /*	/ /	
	High Voltage Neutral Bushing Current Transformers			
	Manufacturer	*		
	Type Designation	*		
	No. of CTs			
	Continuous Thermal Current Rating Factor Protection CT Multi Ratio CTs (MRCT)			

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24 (continued)				
	Single Ratio CTs			
	Rated Short Time Withstand Current			
	Thermal I_{th} (kA)	*		
	Dynamic (kA_{peak})	$2.6xI_{th}$		
	Short Time Thermal Current duration (sec.)			
	Rated primary short circuit current I_{PSC} (kA)	*		
	Temperature Rise (°C)	*		
	Core No.	1 / 2	1 / 2	
	Type of Protection (differential/ REF etc.)	/	/	
	Current Ratio at specified tap	/	/	
	Accuracy Class	/	/	
	Burden (VA)/Resistive Burden-R_b (ohms)	/	/	
	Secondary Winding Resistance at 20°C, R_{ct} (ohms)	/	/	
	<u>For class TPS CTs per IEC</u>			
	Rated symmetrical short circuit current factor -K_{SSC}	*/*	/	
	Dimensioning parameter -K	*/*	/	
	Excitation limiting secondary voltage -U_{al} (Volts)*	*/*	/	
	Accuracy limiting secondary exciting current – I_{al} (mA)	*/*	/	
	Secondary excitation current-I_{mag} at half excitation limiting secondary voltage (mA)	*/*	/	
	<u>For class C or K CTs per IEEE / Class P CT per IEC</u>			
	Magnetizing current -I_{mag} (mA)	*/*	/	

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24 (continued)				
	Knee point voltage $-V_k$ (Volts)/ /Secondary limiting e.m.f	*/*	/	
	Low Voltage Neutral/Common Neutral Bushing Current Transformers for Auto Transformer			
	Manufacturer	*		
	Type Designation	*		
	No. of CTs			
	Continuous Thermal Current Rating Factor			
	Protection CT			
	Multi Ratio CTs (MRCT)			
	Single Ratio CTs			
	Rated Short Time Withstand Current			
	Thermal I_{th} (kA)	*		
	Dynamic (kA_{peak})	$2.6xI_{th}$		
	Short Time Thermal Current duration (sec.)			
	Rated primary short circuit current I_{PSC} (kA)	*		
	Temperature Rise (°C)	*		
	Magnetizing curve enclosed	*	Yes/No	
	Core No.	1 / 2	1 / 2	
	Type of Protection (differential/Distance/REF etc.)	/	/	
	Current Ratio at specified tap	/	/	
	Accuracy Class	/	/	
	Burden (VA)/Resistive Burden-R_b (ohms)	/	/	
	Secondary Winding Resistance at 20°C, R_{ct} (ohms)	/	/	
	Temperature Rise (°C)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24 (continued)				
	For class TPS CTs per IEC			
	Rated symmetrical short circuit current factor -K_{SSC}	*/*	/	
	Dimensioning parameter -K	*/*	/	
	Excitation limiting secondary voltage -U_{al} (Volts)*	*/*	/	
	Accuracy limiting secondary exciting current – I_{al} (mA)	*/*	/	
	Secondary excitation current-I_{mag} at half excitation limiting secondary voltage (mA)	*/*	/	
	For class C or K CTs per IEEE / Class P CT per IEC			
	Magnetizing current -I_{mag} (mA)	*/*	/	
	Knee point voltage -V_k (Volts)/ /Secondary limiting e.m.f	*/*	/	
	Tertiary Bushing Current Transformer			
	Manufacturer	*		
	Type Designation	*		
	No. of CTs per phase			
	Continuous Thermal Current Rating Factor			
	Protection CT			
	Multi Ratio CTs (MRCT)			
	Single Ratio CTs			
	Rated Short Time Withstand Current			
	Thermal I_{th} (kA)	*		
	Dynamic (kA_{peak})	2.6xI_{th}		
	Short Time Thermal Current duration (sec.)			
	Rated primary short circuit current I_{PSC} (kA)	*		
	Temperature Rise (°C)	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24	(continued)			
	Core No.	1 / 2		
	Type of Protection (differential/ REF etc.)	/		
	Current Ratio at specified tap	/		
	Accuracy Class	/		
	Burden (VA)/Resistive Burden-R_b (ohms)	/		
	Secondary Winding Resistance at 20°C, R_{ct} (ohms)	/		
	For class TPS CTs per IEC			
	Rated symmetrical short circuit current factor -K_{SSC}	/		
	Dimensioning parameter -K	/		
	Excitation limiting secondary voltage -U_{al} (Volts)*	/		
	Accuracy limiting secondary exciting current – I_{al} (mA)	/		
	Secondary excitation current-I_{mag} at half excitation limiting secondary voltage (mA)	*/*		
	For class C or K CTs per IEEE / Class P CT per IEC			
	Magnetizing current -I_{mag} (mA)	*/*		
	Knee point voltage -V_k (Volts)/ /Secondary limiting e.m.f	*/*		
	Bushing Current Transformers for W.T.I			
	Manufacturer	*		
	Type Designation	*		
	Ratio			
	HV	*		
	LV	*		
	TV	*		
	Burden (VA)	*		
	Accuracy Class	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24	Terminations			
	Termination for HV Winding			
	Open Bushings (oil/Air)	Yes/No		
	Type of conductor			
	Conductor material			
	Conductor size (mm²)			
	Cable Box			
	Type of cable			
	Cable size (mm²)			
	Material			
	Number of phase			
	Method of termination (Pothead, stress cone, heat shrinkable)			
	Number of terminations			
	Terminal enclosure required	Yes/No		
	Type (Air, Oil)			
	Incoming cable take off method (Vertical, horizontal, Angle to horizontal)			
	GIS (Oil/ SF_6) (For details refer to 32-TMSS-02 Data Schedule and attach relevant data)	Yes/No		
	Bus Duct (If bus duct is required, full details will follow order Placement)	Yes/No		
	Termination for LV winding			
	Open Bushings (oil/Air)	Yes/No		
	Type of conductor			
	Conductor material			
	Conductor size (mm²)			

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24 (continued)				
	Cable Box			
	Type of cable			
	Cable size (mm²)			
	Material			
	Number of phase			
	Method of termination (Pothead, stress cone, heat shrinkable)			
	Number of terminations			
	Terminal enclosure required	Yes/No		
	Type (Oil, Oil)	Yes/No		
	Incoming cable take off method (Vertical, horizontal, Angle to horizontal)			
	GIS (Oil/ SF_6) (For details refer to 32-TMSS-02 Data Schedule and attach relevant data)	Yes/No		
	Bus Duct (If bus duct is required, full details will follow order Placement)	Yes/No		
	Termination for Tertiary Windings			
	Open Bushings	Yes/No		
	Type of conductor			
	Conductor material			
	Conductor size (mm²)			
	Cable Box			
	Type of cable			
	Cable size (mm²)			
	Material			
	Number of phase			
	Method of termination (Pothead, stress cone, heat shrinkable)			

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.24 (continued)				
	Number of terminations			
	Terminal enclosure required	Yes/No		
	Type (Air, Oil)			
	Incoming cable take off method (Vertical, horizontal, Angle to horizontal)			
	GIS (Oil/ SF_6) (For details refer to 32-TMSS-02 Data Schedule and attach relevant data)	Yes/No		
	Bus Duct (If bus duct is required, full details will follow order Placement)	Yes/No		
4.25	Surge Arresters			
	Provision for Surge Arresters mounting required (If surge arresters are required Data Schedule of 35-TMSS-01 shall be completed and attached by the specifying engineer)	Yes/No		
4.26	On line Gas Analyzer with mositure Analyzer	Yes/No		
	AUXILIARY SUPPLIES			
	Voltage for Motors and Controls (V_{ac}/V_{dc})			
	Number of phases			
	Number of wires			
	DC Voltage for Control and Protection.(V_{dc})	125		

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
5.0	WEIGHT AND DIMENSIONS			
	Weight of Core and Coil Assembly (kg)	*		
	Weight of Core (kg)	*		
	Weight of Copper (kg)	*		
	Weight of Oil (kg)	*		
	Total Weight (kg)			
	with oil	*		
	without oil	*		
	Shipping Weight (kg)	*		
	Volume of Oil - Main Tank (liters)	*		
	Volume of Oil - Conservator (liters)	*		
	Overall Dimensions of the Assembled Transformer			
	Height (mm)	*		
	Width (mm)	*		
	Length (mm)	*		
	Maximum Shipping Dimension Transformer			
	Height (mm)	*		
	Width (mm)	*		
	Length (mm)	*		
	Shipping			
	Maximum permissible acceleration during shipment in, (g)			
	Lateral direction	*		
	Longitudinal direction	*		

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
5.0 (continued)				
	Vertical direction	*	________	________
	Maximum Guaranteed Permanent Deflection			
	Under Pressure test. (mm)	*	________	________
	Under Vacuum test (mm)	*	________	________
6.3	Special Tests Please list special tests that shall be required	________	________	________
	TRANSPORTATION LIMITATIONS			
	(If yes, specify the maximum overall dimensions of the transformer or attach the route or profile)	*	________	________

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED ABOVE 2.5 MVA

A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES TO BE FURNISHED BY NATIONAL GRID, SAUDI ARABIA:

B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/VENDOR/SUPPLIER/CONTRACTOR:

C. OTHER PARTICULARS TO BE FILLED UP BY BIDDER/VENDOR/SUPPLIER/CONTRACTOR:

	Actual Manufacturer of Equipment/Material	Vendor/Supplier/ Contractor
Name of the Company Location and address	__________ __________ __________	__________ __________ __________
Name and Signature of authorized representative and date	__________ __________ __________	__________ __________ __________
Official Seal/Stamp of the Company & Date	__________	__________

7.0 DATA SCHEDULE

UNINHIBITED INSULATING MINERAL OIL

Enquiry No. ______________________________ Date: __________

Purchase Order No.
or Contract No. ______________________________ Date: __________

PTS No./Project Title with J.O. No. ______________________________

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
3.0	APPLICABLE INDUSTRY. STANDARD	IEC 60296	________	________
4.0	PERFORMANCE REQUIREMENTS AND CHARACTERISTICS			
	Classification/Type of oil	*	________	________
	Manufacturer's Designation of oil	*	________	________

'A' - NATIONAL GRID, SAUDI ARABIA SPECIFIED DATA/PARAMETER
'B' - BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS
'C' - REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'
(*) - DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/ SUPPLIER/VENDOR/CONTRACTOR IN COLUMN 'B'.

7.0 DATA SCHEDULE

UNINHIBITED INSULATING MINERAL OIL

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4 (Cont'd)				
	Type of crude oil used	*		
	Oil before Filling in Transformer			
	Appearance/visual examination	clear free from sediment & suspen-ded matter		
	Color, Max.	*		
	Kinetic Viscosity, Max. (mm²/s) at :			
	-30ºC (ISO 3104)	1800		
	+ 40 °C (ISO 3104)	12		
	Flash point, Min. (°C) (ISO 2719)	135		
	Pour point, Max. (°C) (ISO 3016)	-40		
	Density, Max, (g/cm³)			
	+ 20°C (ISO3675/ISO12185)	0.895		
	Interfacial tension at 25°C, Min. (dynes/cm) (EN14210/ASTM D971)	40		

7.0 DATA SCHEDULE

UNINHIBITED INSULATING MINERAL OIL

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4 (Cont'd)				
	Dielectric Breakdown Voltage at 60Hz, Min. (kV) (IEC 60156)			
	• As delivered	30		
	Dielectric Dissipation Factor (Loss Tangent), at 60Hz, Max. at (IEC 60247/IEC 61620):			
	90 °C	0.005		
	Particle Content (IEC 60970)	No Genl. Reqmt		
	Acidity Max. (mg KOH/g) (IEC 62021-1/IEC 62021-2)	0.01		
	Oxidation Stability : IEC 61125(C)			
	- Test Duration	164H		
	-Total Acid number,Max. (mg KOH/g) (Cl. 1.9.4 of IEC 61125)	1.2		
	-Sludge, Max (% by mass) (Cl. 1.9.1 of IEC 61125)	0.8		
	- DDF at 90°C Max. (Cl. 1.9.6 of IEC 61125 Amedtmt. 1 + IEC 60247)	0.500		
	Water content at delivery, Max (ppm) (IEC 60814)			
	- in Drums	40		
	- in Tank container	30		
	Total Sulphur content, Max. (IP 373/ISO14596)	*		
	Corrosive Sulphur (DIN 51353)	Non Corrosive		

7.0 DATA SCHEDULE

UNINHIBITED INSULATING MINERAL OIL

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4 (Cont'd)	Inhibitors (IEC 60666) (U-Uninhibited) Presence of Anti oxidant	Not Detectable		
	Metal Passivator Additives (IEC 60666)	Not Detectable		
	Anti Oxidants (IEC 60666)	Not Detectable		
	Lowest cold start energizing Temperature (LCSET)	*		
	P. C. B Content (IEC 61619)	Not Detectable		
	P. C. A Content, Max. (%) 3.0 (IP 346)	*		
	2-Furfural and related compounds, Max. (mg/kg) <0.**05** (IEC 61198)	Not Detectable		
	Stray Gassing (Cl. 6.22 of IEC 60296)	*		
	Gassing Tendency, Max. (µL/min.) IEC 60628 (A) H_2	+30		
5.2	Corrosive Sulphur Per IEC 62535	Noncorrosive		
5.3	DBDS (IEC 62697-1)	Not Detectable		

7.0 DATA SCHEDULE

UNINHIBITED INSULATING MINERAL OIL

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
5.6.1	Electrostatic charging tendency (if applicable)	*	______	______
6.0	MODE OF DELIVERY			
	Drums or tank container capacity	*	______	______
	Total number of drums or tank container	*	______	______
	Weight of oil in each drum or tank container	*	______	______

7.0 DATA SCHEDULE

UNINHIBITED INSULATING MINERAL OIL

A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES TO BE FURNISHED BY NATIONAL GRID, SAUDI ARABIA:

B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/VENDOR/SUPPLIER/CONTRACTOR:

C. OTHER PARTICULARS TO BE FILLED UP BY BIDDER/VENDOR/SUPPLIER/ CONTRACTOR:

	Actual Manufacturer of Equipment/Material	Vendor/Supplier/ Contractor
Name of the Company Location and address	______________________	______________________
Name and Signature of authorized epresentative and date	______________________	______________________
Official Seal/Stamp of the Company & Date	______________________	______________________

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

National Grid Saudi Arabia Enquiry No. ____________________ Date: __________

National Grid Saudi Arabia Purchase Order No. or Contract No. ____________________ Date: __________

National Grid Saudi Arabia PTS No./Project Title with J.O. No. ____________________

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
3.0	APPLICABLE CODES AND STANDARDS			
	Applicable Industry Standard	*		
4.0	DESIGN AND CONSTRUCTION REQUIREMENTS			
	Model Designation	*		
4.1	No. of phases	3/1		
4.2	Performance Characteristics and Rating	Fixed/Variable		
	Regulation Range (% of Maximum Rated Power) for Variable Shunt Reactor			
	Rated Power (Mvar) at Rated Voltage			
	Cooling method			
	Rated nominal system Voltage (33kV or 34.5, 69, 110, 115, 132, 230, 380)			
	Maximum operating voltage (Um) kV			
	Linearity (%)			
	Frequency (Hz)	60		

A'- NATIONAL GRID SAUDI ARABIA SPECIFIED DATA/PARAMETER.
'B'- BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS.
'C'- REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'.
(*)- DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/SUPPLIER/ VENDOR/CONTRACTOR IN COLUMN 'B'.

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.2	(*Continued*)			
	Rated short time current (kA)			
	Duration (sec)			
	Type	Line Reactor/ Bus Reactor		
	Noise level			
	ONAN rating (dB)	*		
	ONAF rating (dB) (if specified)	*		
	Vector group	YN		
	Reactance:			
	100% rated voltage (ohms)	*		
	110% rated voltage (ohms)	*		
	Maximum Tap Position (ohms)	*		
	Intermediate Tap Position (ohms)	*		
	Minimum Tap Position (ohms)	*		
	Zero sequence reactance (ohms)	*		
	Mutual reactance (ohms)	*		
	Harmonic current (%)			
	3rd harmonic (%)	*		
	5th harmonic (%)	*		
	Permissible unbalance current among different phases (%)			
	Ratio of zero sequence reactance to positive sequence reactance			
	Max. rated power at rated voltag (Mvar)	*		
	Min. rated power at rated voltag (Mvar)	*		
	Max. rated power at max. voltage (Mvar)	*		
	Min. rated power at max. voltage (Mvar)	*		
	Max. rated current (A) at rated voltage	*		
	Min. rated current (A) at rated voltage	*		
	Max. rated current (A) at max. voltage	*		
	Min. rated current (A) at max.voltage	*		

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.2	*(Continued)*			
	Temperature Rise Based on Ambient Conditions Specified in 01-TMSS-01			
	Winding (°C)	*		
	Oil (°C)	*		
	Winding maximum (Hot spot) temperature	*		
	Low Voltage Winding	Yes/No		
	Rated Voltage(V)	$400V_{ac}$		
	Rating (kVA)			
4.3	Construction			
4.3.1	Maximum Design Flux Density at Rated Voltage (Tesla)	*		
	Flux density at 110% rated voltage (Tesla)	*		
	Saturation Voltage ($\%U_N$)	*		
	Knee Point in Magnetic flux versus Current curve (curve to be enclosed)	*	Yes/No	
4.3.2	Maximum Impulse Withstand Voltage			
	Line Terminal (kV_{peak})	*		
	Neutral Terminal (kV_{peak})	*		
	Separate Source Power Frequency Withstand Voltage			
	Line Terminal (kV_{rms})	*		
	Neutral Terminal (kV_{rms})	*		
	Switching impulse withstand voltage			
	Line Terminal (kV_{peak})	*		
	Neutral External Connection	Solid Grounding/ Neutral Reactor		

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.2	*(Continued)*			
	Winding Insulation	Uniform/ Non-uniform		
4.3.3/4.3.4	Type of tank construction			
	Tank Cover	Welded		
	Min. thickness of tank steel (mm)	*		
	Min. Thickness of radiator plates (mm)	*		
	Maximum Positive Withstand Pressure of Tank and Radiators (kPa)	*		
	Minimum Vacuum Withstand (kPa)	*		
4.3.6	Guaranteed Losses at 100% rated voltage	*		
	Losses at:			
	110% rated voltage (kW)	*		
	Auxiliary Losses	*		
	Maximum Tap Position (kW)	*		
	Intermediate Tap Position (kW)	*		
	Minimum Tap Position (kW)	*		
4.3.7	Buchholz Relay			
	Manufacturer	*		
	Type Designation	*		
	Alarm/Trip Contact Current Rating at 125Vdc	*		
4.3.8	Pressure Relief Device for Main Tank			
	Manufacturer	*		
	Type Designation	*		
	Number of Pressure Relief Device(s)	*		
	Pressure Range for Operation (From to kPa)	*		
	Resealing Pressure (kPa)	*		
	Number of alarm/trip contacts	2		
	Alarm Contact Current Rating at 125 Vdc (A)	*		
4.3.9	Maintenance free Breather	Yes/No		

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.10	Oil Temperature Indicator			
	Manufacturer	*		
	Type Designation	*		
	Type of Liquid Sensing Element	*		
	Provision of maximum indicator	Yes/No		
	Adjustment Range of Alarm and Trip contacts (From_to_°C)	0-160ºC		
	Contact Current Rating at 125 V_{dc} (A)	*		
	Number of contacts	4		
4.3.11	Winding Temperature Indicator			
	Manufacturer	*		
	Type Designation	*		
	Provision of Maximum Indicator	Yes/No		
	Adjustment Range of Alarm and Trip Contacts (From_to_°C)	0-160ºC		
	Contact Current Rating at 125 V_{dc} (A)	*		
	Number of contacts	4		
4.3.12	Fiber Optic Sensors	Yes/No		
	Manufacturer	*		
	Type Designation	*		
	No. of Fiber Optic Sensors	*		
4.3.13	Oil Level Indicator			
	Manufacturer	*		
	Type Designation	*		
	Alarm Contact Current Rating at 125 V_{dc} (A)	*		
4.3.14	Off Load Tap Changer			
	Manufacturer	*		
	Number of steps			
	Step Voltage (%)			
	Tapping Range (%)			

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.15	Onload Tap Changer (OLTC)			
	Manufacturer	*		
	Country of origin	*		
	Type	Vacuum		
	Type Designation	*		
	Tap Arrangment (Linear, Reversing or Coarse/fine)	*		
	Number of steps			
	Step Voltage (%)			
	Size of reactive power each Steps (Mvar)	2.5		
	Regulation Range (%)			
	Rated Through Current (A)	*		
	Short Circuit Current (kA)	*		
	Dynamic short circuit current (kApeak)	*		
	Location (In-tank type fitted inside reactor main tank/outside reactor main tank or External mounted type)	*		
	Voltage Class (kVrms)	*		
	BIL (kVpeak)	*		
	Type of transition impedance (high resistance)	*		
	Time of transfer from one step to another			
	- motor-operated (seconds)	*		
	- manually operated (Number of revolution)	*		
	Oil filter unit for OLTC	*		
	Motor drive unit:			
	Type	*		
	Power	*		
	Rated Voltage (Vac)/(Vdc)	*		
	Number of phases	*		
	Control voltage (Vac or Vdc)	*		
	Space heater (Vac)	*		
	Heater Wattage (W)	*		

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.15	*(Continued)*			
	Oil/Gas Surge Relay for OLTC	*		
	Manufacturer	*		
	Country of origin	*		
	Type Designation	*		
	Alarm/Trip Contact Current Rating at 125 V_{dc} (A)	*		
	Pressure Relief Device (OLTC)			
	Manufacturer	*		
	Country of origin	*		
	Type Designation	*		
	Number of Pressure Relief Device(s)	*		
	Resealing Pressure (kPa)	*		
	Number of alarm/trip contacts	*		
	Alarm/Trip Contact Current Rating at 125 V_{dc} (A)	*		
4.3.16	Ladder	Yes/No		
4.3.17	Drain, Filter and Sampling Valves			
	Type & Size of Oil Drain Valve (mm) (attach drawing)	50		
	Type and Size of Filtration Valves (mm) (attach drawing)	50		
	Size of Oil Sampling Valve/s (mm) (attach drawing)	20		
	Type & Size of Radiator Valves (mm) (attach drawing)	*		
4.3.19	Moving Facilities			
	Reactor Base Type	Skid/Wheels		
	Wheel Details			
	Wheels Center to Center Distance			
	(1100/2100/3100mm)	*		

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.23	Bushings			
	High Voltage Bushings:			
	Manufacturer	*		
	Type designation	*		
	Material	*		
	Location (top, side, others)			
	Terminal take off angle (vertical, horizontal, angle)			
	Number			
	Rated Voltage (kV)			
	Rated Maximum Voltage (kV)			
	Rated current (A)	*		
	BIL (kVpeak)	*		
	Switching Impulse Withstand Voltage, if applicable (kVpeak)	*		
	Power Frequency Dry/Wet Withstand Voltage (kVrms)	*		
	Creepage distance (mm)	*		
	Cantilever strength (kN)	*		
	Mounting details			
	Hole circle diameter of the flange (mm)	*		
	Number of bolts	*		
	Hole diameter (mm)	*		
	Terminal			
	Type	*		
	Size	*		
	No. of holes, if applicable	*		
	Neutral Bushings:			
	Manufacturer	*		
	Type designation	*		
	Material	*		
	Location (top, side, others)			
	Terminal take-off angle (vertical, horizontal, angle)			
	Rated Voltage (kV)	*		

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.23	*(Continued)*			
	Rated Current (A)	*		
	BIL (kVpeak)	*		
	Power Frequency Dry/Wet Withstand Voltage (kVrms)	*		
	Creepage distance (mm)	*		
	Cantilever strength (kN)	*		
	Mounting details			
	Hole circle diameter of the flange (mm)	*		
	Number of bolts	*		
	Hole diameter (mm)	*		
	Terminal			
	Type	*		
	Size	*		
	No. of holes (if applicable)	*		
4.3.24	Bushing Current Transformers for W.T.I.			
	Manufacturer	*		
	Type Designation	*		
	Ratio	*		
	Accuracy Class	*		
	Neutral Bushing Current Transformer			
	Manufacturer	*		
	Type Designation	*		
	No. of CTs per Phase			
	Continuous Thermal Current Rating Factor			
	- Multi Ratio CTs (MRCT)			
	- Single Ratio CTs			
	Rated Short Time Withstand Current			
	- Thermal I_{th} (kA)	*		
	- Rated Dynamic current	2.6xI_{th}		
	Short Time Thermal Current duration (sec.)	*		
	Rated primary short circuit current I_{PSC} (kA)	*		

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.24	*(Continued)*			
	Temperature Rise (°C)	*		
	Core No.			
	Type of Protection (differential etc.)			
	Current Ratio at specified tap			
	Accuracy Class			
	Burden (VA)/Resistive Burden-R_b (ohms)	*		
	Secondary Winding Resistance at 20°C, R_{ct} (ohms)	*		
	For class TPS CTs per IEC			
	Rated symmetrical short circuit current factor -K_{SSC}	*		
	Dimensioning parameter -K	*		
	Excitation limiting secondary voltage -U_{al} (Volts)	*		
	Accuracy limiting secondary exciting current – I_{al} (mA)	*		
	Secondary excitation current-I_{mag} at half excitation limiting secondary voltage (mA)	*		
	For class C or K CTs per IEEE / Class P CTs per IEC			
	Magnetizing current -I_{mag} (mA)	*		
	Knee point voltage -V_k (Volts)/ Secondary limiting e.m.f	*		
4.3.27	Auxiliary Supplies			
	DC Voltage for Control and Protection. (V_{dc})	125		
4.3.28	Terminations			
	Termination for HV Winding:	Yes/No		
	Open Bushings (oil/Air)			
	Type of conductor			
	Conductor material			
	Conductor size (mm²)			

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.28	*(Continued)*			
	Cable Box:	Yes/No		
	Type of cable			
	Cable size (mm²)			
	Material			
	Number of phase			
	Method of termination (Pothead, stress cone, heat shrinkable)			
	Number of terminations			
	Terminal enclosure required	Yes/No		
	Type (Air, Oil)			
	Incoming cable take off method (Vertical, horizontal, Angle to horizontal)			
	GIS (Oil/SF6):	Yes/No		
	(For details refer to 32-TMSS-02 Data Schedule and attach relevant data)			
	Bus Duct:	Yes/No		
	(If bus duct is required, full details will follow order Placement)			
	Pressure Relief Device for Oil Cable Box			
	Manufacturer	*		
	Type Designation	*		
	Number of Pressure Relief Device(s)	*		
	Pressure Range for Operation (From to kPa)	*		
	Resealing Pressure (kPa)	*		
	Number of alarm/trip contacts	2		
	Alarm Contact Current Rating at 125 Vdc (A)	*		
4.3.29	Surge Arresters	Yes/No		
	Provision for Surge Arresters Mounting Required (If surge arresters are required Data Schedule of 35-TMSS-01 shall be completed and attached by specifying engineer)			

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3.30	Reactor Oil			
	(Manufacturer shall fill up column 'B' of 54-TMSS-01 data schedule)			
4.3.31	Online Gas Analyzer with mositure Analyze	Yes/No		
	ADDITIONAL INFORMATION			
	Approximate Shipping Dimension			
5.5	Special Tests Please list special tests that shall be required			

6.0 DATA SCHEDULE

OIL IMMERSED SHUNT REACTOR 33kV THROUGH 380kV

A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES TO BE FURNISHED BY NATIONAL GRID SAUDI ARABIA:

B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/VENDOR/SUPPLIER/CONTRACTOR:

C. OTHER PARTICULARS TO BE FILLED UP BY BIDDER/VENDOR/SUPPLIER/ CONTRACTOR:

	Actual Manufacturer of Equipment/Material	Vendor/Supplier/ Contractor
Name of the Company Location and address	______________________ ______________________ ______________________	______________________ ______________________ ______________________
Name and Signature of authorized representative and date	______________________ ______________________ ______________________	______________________ ______________________ ______________________
Official Seal/Stamp of the Company & Date	______________________ ______________________	______________________ ______________________

APPENDIX-3

PROTECTION REQUIREMENTS

PROTECTION ENGINEERING DEPARTMENT

APPENDIX

PROTECTION CT REQUIREMENTS FOR PURCHASE CONTRACT FOR TRANSFORMERS AND REACTORS (24CM1046)

DESCRIPTION

NO.	1	2	3

REVISIONS

DEPARTMENT
PROTECTION ENGINEERING

PREPARED BY
Umer Ehsan
DATE: 11/ 09/ 2024

APPROVED BY
Umer Ehsan
DATE: 11-09-2024

CERTIFIED BY
Murshed A. Al Taleb
DATE: 11/ 09/ 2024

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Contents

NO.	1	2	3
DESCRIPTION			

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DEPARTMENT
PROTECTION ENGINEERING

PREPARED BY
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A. 110/13.8 KV YNyn0+d1, X/R= (as per PTS), %age impedance as per PTS 50-67 MVA solidly grounded from HV side

132/13.8 KV YNyn0+d1, X/R= (as per PTS), %age impedance as per PTS 50-67 MVA solidly grounded from HV side

132/13.8 KV Dyn1, X/R= as per PTS, %age impedance (as per PTS) 50-67 MVA

115/13.8 KV Dyn1, X/R= as per PTS, %age impedance (as per PTS) 50-67 MVA

1- 132 KV or 115kV or 110kV High Voltage Bushings Side

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
CT-1	600/1	PX	≥ 720	≤ 2	≤ 25	-	Spare for 87 T-1
	300/1		≥ 360	≤ 1	≤ 50		
CT-2	600/1	PX	≥ 720	≤ 2	≤ 25	-	Spare for 87 T-2
	300/1		≥ 360	≤ 1	≤ 50		
CT-3	2000/1	PX	≥ 1400 @ 800A	≤ 2 @ 800A	30 mA @ 800A	-	Spare for Line Protection
	1600/1						
	1200/1						
	1000/1						
	800/1						
CT-4	49WT – For Winding Temperature as per NG standard						

2- 132 KV or 110kV High Voltage Neutral Bushing Side (if applicable)

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
NCT-1	600/1	PX	≥ 720	≤ 2	≤ 25	-	REF-1
	300/1		≥ 360	≤ 1	≤ 50		
NCT-2	600/1	PX	≥ 720	≤ 2	≤ 25	-	REF-2
	300/1		≥ 360	≤ 1	≤ 50		

3- 13.8 KV Medium Voltage Bushings Side

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
CT-5	As per NG standard						AVR
CT-6	As per NG standard						49W

NO.	DESCRIPTION
1	
2	
3	

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DRAWING CONTROL SHEET	Protection CT Requirements for Purchase Contract for Transformers and Reactors (24CM1046)	PLANT NO.	INDEX	DOCUMENT NO.	PAGE NO.	REV.
XT-XXX		NG2150	A	24CM1046	3 OF 6	1

4- 13.8 KV MV Neutral Bushings

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
NCT-3	3600/1	PX	≥ 800	≤ 16	≤ 25	-	REF-1
NCT-4	3600/1	PX	≥ 800	≤ 16	≤ 25	-	REF-2
NCT-5	1500-800/1	5P20	-	-	-	30	SBEF-1
NCT-6	1500-800/1	5P20	-	-	-	30	SBEF-2

All CTs shall have continuous thermal Current Rating factor of 1.2 at 55°C.

B. 132/33 KV YNyn0+d1, X/R= as per PTS, 80-100 MVA solidly grounded from HV side

1- 132 KV High Voltage Bushings Side

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
CT-1	600/1	PX	≥ 720	≤ 2	≤ 25	-	Spare for 87 T-1
	300/1		≥ 360	≤ 1	≤ 50		
CT-2	600/1	PX	≥ 720	≤ 2	≤ 25	-	Spare for 87 T-2
	300/1		≥ 360	≤ 1	≤ 50		
CT-3	2000/1	PX	≥ 1400 @ 800A	≤ 2 @ 800A	30 mA @ 800A	-	Spare for Line Protection
	1600/1						
	1200/1						
	1000/1						
	800/1						
CT-4	49WT – For Winding Temperature as per NG standard						

DESCRIPTION

NO.	1	2	3

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2- 132 KV High Voltage Neutral Bushing Side

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
NCT-1	600/1	PX	≥ 720	≤ 2	≤ 25	-	REF-1
	300/1		≥ 360	≤ 1	≤ 50		
NCT-2	600/1	PX	≥ 720	≤ 2	≤ 25	-	REF-2
	300/1		≥ 360	≤ 1	≤ 50		

3- 13.8 KV Medium Voltage Bushings Side

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
CT-5	As per NG standard						AVR
CT-6	As per NG standard						49W

4- 33 KV MV Neutral Bushings

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
NCT-3	2000/1	PX	≥ 600	≤ 6	≤ 50	-	REF-1
NCT-4	2000/1	PX	≥ 600	≤ 6	≤ 50	-	REF-2
NCT-5	3000-1500/1	5P20	-	-	-	30	SBEF-1
NCT-6	3000-1500/1	5P20	-	-	-	30	SBEF-2

30VA 5P20 (at lowest ratio) CT with suitable CT Ratio as per the power and voltage rating for earth fault protection of Tertiary winding, subject to PED approval.

DESCRIPTION

NO.	1	2	3

REVISIONS

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PROTECTION ENGINEERING

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DATE: 11/ 09/ 2024

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C. 40MVAR, 132kV Bus Shunt Reactor Connected in Grid

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
CT-1	As per NG standard						49W

1- Three Phase Neutral Bushing's CTs (Before the Neutral Point).

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
CT-2	600/1	PX	≥ 720	≤ 2	≤ 25	-	87R1
	300/1		≥ 360	≤ 1	≤ 50		
CT-3	600/1	PX	≥ 720	≤ 2	≤ 25	-	87R2
	300/1		≥ 360	≤ 1	≤ 50		

2- Reactor Grounding CTs on the Neutral Connection

CT#	Ratio [A/A]	Class	Vk [V]	Rct [Ω]	Imag [mA]	Burden [VA]	Application
CT-4	600/1	PX	≥ 720	≤ 2	≤ 25	-	SPARE
	300/1		≥ 360	≤ 1	≤ 50		
CT-5	600/1	PX	≥ 720	≤ 2	≤ 25	-	50N / 51N
	300/1		≥ 360	≤ 1	≤ 50		

The above shall be considered a minimum requirement but in all cases the each and every protection core CT must be justified for the requirement in accordance with the relay manufacturers recommendations. The CTs shall have adequate performance to enable the associated protection to perform their intended functions without any limitation caused by saturation and an X/R ratio up to as per PTS. All CTs shall have continuous thermal Current Rating factor of 1.2 at 55°C.

DESCRIPTION | NO. | 1 | 2 | 3

REVISIONS

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PROTECTION ENGINEERING

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DATE: 11/ 09/ 2024

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DATE: 11-09-2024

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Murshed A. Al Taleb
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APPENDIX-4

TRAINING REQUIREMENTS

APPENDIX-5

OPERATIONAL SPARE PARTS REQUIREMENTS

APPENDIX-6

SPECIAL TOOLS & EQUIPMENT REQUIREMENTS

APPENDIX

FOR

SPECIAL TOOLS & EQUIPMENT

NOVEL CONTRACT PROCUREMENT DIVISION
PROJECTS CONTRACT DEVELOPMENT DEPARTMENT
ENGINEERING & ASSET MANAGEMENT
NATIONAL GRID SAUDI ARABIA

DESCRIPTION
NO. | 1 | 2 | 3

REVISIONS

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Sultan Ibrahim Al-Rayes
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DRAWING CONTROL SHEET	SPECIAL TOOLS & EQUIPMENT		PLANT NO.	INDEX	DOCUMENT NO.	PAGE NO.	REV.
XT-XXXXXX	XXXXXXX	SAUDI ARABIA	NGXXX	A	Appendix	1 OF 2	0

A. Power transformer and Bus Reactor:

Tools for 50/67MVA, 80/100MVA,400MVA ,115/13.8kV,110/13.8 kV,132/13.8kV ,132/33kV ,230/115/34.5 kV, Transformer & 230 kV 80 MVAR,132kV 40MVAR bus reactor.

1. One (1) set Lifting jacks (4nos) each, Jigs or special bolts, etc for lifting core and winding for TRANSFORMERS AND BUS REACTOR.
2. One (1) set Open wrenches, size 6", 8" & 10"
3. One (1) set Adjustable wrenches, size 6", 8" & 10"
4. One (1) set Socket wrenche.
5. One (1) set Torque wrench.
6. One (1) set C –Clamp.
7. One (1) set Manila rope 18dia, 10m.
8. One (1) set Wire rope 6x37, 38dia, 15m

---------- End ---------

NO.	1	2	3
DESCRIPTION			

REVISIONS

DEPARTMENT
PCDD

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